COURSE OUTLINE BRIEFS

SARGODHA UNIVERSITY

Pathway to Progress

FACULTY OF ENGINEERING & TECHNOLOGY

LIST OF DEPARTMENTS

COURSE OUTLINE BRIEFS

COLLEGE OF ENGINEERING AND TECHNOLOGY

SARGODHA UNIVERSITY
Pathway to Progress

FACULTY OF ENGINEERING AND TECHNOLOGY

OVERVIEW

Technology holds the key to progress and development of any nation. It plays fundamental role in wealth creation, improvement of the quality of life and real economic growth and transformation in any society. While engineers, by applying the principles of Mathematics and Science, develop solutions to the world's biggest technical issues.

The College of Engineering and Technology was established in 2013 with the objective to impart quality education in the field of Engineering and Technology. The College offers graduate degree programs in Civil, Electrical and Mechanical Engineering and Technical Education. The College, being the constituent part of the University, has benefits of having qualified teachers for the subjects like English, Social Sciences, Pakistan Studies, Physics, Chemistry and Computer Sciences. The highly qualified faculty of the College, in the perspective of growing trends of value-addition and knowledge-based economy, is doing its best to ignite students' critical thinking, curiosity and creativity as well as getting them ready to handle the constantly changing world.

COURSE
OUTLINE BRIEFS

DEPARTMENT OF
CIVIL ENGINEERING

SARGODHA UNIVERSITY

Pathway to Progress

FACULTY OF
ENGINEERING AND TECHNOLOGY

OVERVIEW

Civil Engineering is the spine of any nation, as the civil engineers build the infrastructure of the nation. The Department of Civil Engineering (DCE) is one of three departments at the College of Engineering & Technology (CET), UOS. In 2014, with an approval from Pakistan Engineering Council (PEC), Bachelor of Sciences (BS) in Civil Engineering program started w. e. f. Fall Semester in September 2014. Currently, the curriculum is based on the Outcome-based Education (OBE), which is in line with the requirements of PEC and Higher Education Commission (HEC) of Pakistan. A team of dedicated faculty and staff members (many holding MS from the renowned national and international Universities) teach and train the best mind of the area.

MISSION STATEMENT

Mission of Department of Civil Engineering, UOS is:
"To provide an educational, professional and intellectual environment for students, faculty, alumni and staff that enables them to contribute to society through teaching, research practice and services".

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

As per recommendation of the Industrial advisory Board (IAB) Civil Engineering program has following objectives:

PEO1: Apply the knowledge to investigate, analyze, design and solve the real world complex problems in the area of Civil Engineering

PEO2: Demonstrate the effective communication in multi-disciplinary environment

PEO3: Enhance the skills by learning the modern tool and techniques

PEO4: Make ethical decisions at individual, team and project level by considering the social and environmental concerns.

Academic Programs Offered.

1. BSc Civil Engineering
2. BSc Mechanical Engineering
3. BSc Electrical Engineering
4. BS Civil Engineering Technology
5. BS Mechanical Engineering Technology
6. BS Electrical Engineering Technology

BSc Civil Engineering

Eligibility: At least 60% marks in FSc. (Pre-Engineering) or equivalent
Merit Determination: 70% Weightage of FSc. marks and 30% weightage of UET Entry Test
Duration: 4 Years
Semesters: 8
Degree Requirements: Minimum 130 cred.it hours

Semester-1

Course Code	Course Title	Lec. Hrs	Lab. Hrs	SCH
CE-111	Civil Engineering Drawing	1	0	1
CE-112	Civil Engineering Drawing Lab	0	6	2
CE-113	Basic Electromechnical Engineering	2	0	2
CE-114	Basic Electromechnical Engineering Lab	0	6	2
CE-115	Civil Engineering Materials	2	0	2
CE-116	Civil Engineering Materials Lab	0	3	1
ENG-117	Functional English	2	0	2
MATH-118	Applied. Calculus	3	0	3
PK. ST-119	Pakistan Studies	1	0	1

Semester-2

Course Code	Course Title	Lec. Hrs	Lab. Hrs	SCH
CE-121	Elementry Surveying	2	0	2
CE-122	Elementry Surveying Lab	0	3	1
CE-123	Engineering Mechanics	3	0	3
CE-124	Engineering Mechanics Lab	0	3	1

Geol-125	Engineering Geology	2	0	2
MATH-126	Applied. Differential Equations	3	0	3
CE-127	Civil Engineering Construction & Graphics	1	0	1
CE-128	Civil Engineering Construction & Graphics Lab	0	6	2
ISL-129	Islamic Studies	2	0	2

Semester-3

Course Code	Course Title	Lec. Hrs	Lab. Hrs	SCH
CE-211	Surveying and GIS - RS Applications	2	0	2
CE-212	Surveying and GIS - RS Applications Lab	0	3	1
CE-213	Mechanics of Solids-I	2	0	2
CE-214	Mechanics of Solids-I Lab	0	3	1
IT-215	Computer Programming	1	0	1
IT-216	Computer Programming Lab	0	6	2
CE-217	Engineering Economics	2	0	2
CE-218	Construction Engineering	3	0	3
MATH-219	Numerical Analysis	3	0	3

Semester-4

Course Code	Course Title	Lec. Hrs	Lab. Hrs	SCH
CE-221	Fluid Mechanics	3	0	3
CE-222	Fluid Mechanics Lab	0	3	1
CE-223	Soil Mechanics	3	0	3
CE-224	Soil Mechanics Lab	0	3	1
CE-225	Structural Analysis-I	3	0	3
MATH-226	Probability and Statistics	2	0	2
MATH-227	Probability and Statistics Lab	0	3	1
CE-228	Mechanics of Solid-II	2	0	2
CE-229	Mechanics of Solid-II Lab	0	3	1

Semester-5

Course Code	Course Title	Lec. Hrs	Lab. Hrs	SCH
CE-311	Advanced. Fluid Mechanics	3	0	3
CE-312	Advanced. Fluid Mechanics Lab	0	3	1
CE-313	Reinforced. Concrete Design-I	3	0	3
CE-314	Reinforced. Concrete Design-I Lab	0	3	1
CE-315	Structural Analysis-II	3	0	3
CE-316	Quantity & Cost Estimation	2	0	2
CE-317	Quantity & Cost Estimation Lab	0	3	1
SOC-318	Business Communication	2	0	2
SOC-319	Professional Ethics	2	0	2

Semester-6

Course Code	Course Title	Lec. Hrs	Lab. Hrs	SCH
CE-321	Environmental Engineering-I	2	0	2
CE-322	Environmental Engineering-I Lab	0	3	1
CE-323	Reinforced. Concrete Design-II	3	0	3
CE-324	Reinforced. Concrete Design-II Lab	0	3	1
CE-325	Transportation Engineering-I	3	0	3
CE-326	Construction Management	2	0	2
CE-327	Construction Management Lab	0	3	1
CE-328	Engineering Hydrology	2	0	2
CE-329	Engineering Hydrology Lab	0	3	1
CE-330	Architecture & Town Planning	3	0	3

Semester-7

Course Code	Course Title	Lec. Hrs	Lab. Hrs	SCH
CE-411	Environmental Engineering-II	2	0	2
CE-412	Geotechnical & Foundation Engineering	3	0	3
CE-413	Geotechnical & Foundation Engineering Lab	0	3	1
CE-414	Transportation Engineering-II	3	0	3
CE-415	Transportation Engineering-II Lab	0	3	1
CE-416	Hazard and Disaster Management	3	0	3
CE-417	Civil Engineering Project	0	9	3

Semester-8

Course Code	Course Title	Lec. Hrs	Lab. Hrs	SCH
CE-421	Geo Informatics	1	0	1
CE-422	Geo Informatics Lab	0	3	1
CE-423	Steel Structures	3	0	3
CE-424	Hydraulics & Irrigation Engineering	3	0	3
CE-425	Hydraulics & Irrigation Engineering Lab	0	3	1
SOC-426	Citizenship ed.ucation & Community Engagement	1	0	1
SOC-427	Citizenship ed.ucation & Community Engagement	0	6	2
CE-417(B)	Civil Engineering Project	0	9	3

BSc
CIVIL ENGINEERING

CE-111 **Civil Engineering Drawing** **3 (1+2)**

Drawing is an art of representing objects or forms on a surface chiefly by means of lines, using any of the wide variety of tools and techniques. It is also called. The language of engineers. It generally involves making marks on a surface by moving pencil, ink pen, wax color pencils or any marker on a plane surface such as paper, canvas etc. Drawings represent reduced. Shape of structure. An engineer must be well conversant with drawings. The aim of this course is to teach students to communicate using graphic techniques. This involves learning to "read" or interpret the information contained. in a 2D engineering drawing. After the completion of this course the student will be able to understand the basics of engineering drawing and able to prepare and understand engineering drawings. It also focuses to provide the students with knowled.ge of principles and techniques of manual construction drawing. They will be able to construct the structures at the site properly.

Contents

1. Introduction to Engineering Drawing and Types of Civil Engineering Drawings: Drawing instruments and their use, Type of drawing lines and appropriate uses, General rules for drawing lines, Gothic lettering, Dimensioning, Planning of a drawing sheet
2. Conceptual Drawings and Projection system: Conceptual drawing Projection system and its variables Classification of projections Perspective and parallel projections Oblique projection Axonometric projection (isometric projection) Orthographic projections (First-angle and third-angle projection) and their comparison Importance of line types and rules
3. Architectural Plan, Elevation and Section of a Simple Building: Architectural views (Plan, elevation, and section) of a simple building, General terminologies and symbols including scheduled. of opening Architectural design of a house.
4. Structural Details of a Simple Building: Foundation plan, Plinth plan, Lintel plan, Slab plan, Cross-sectional details of foundation, columns, vertical stiffeners, plinth band, lintel band, lintels, beams and slabs General notes
5. Architectural and Structural Details of Boundary Wall and Staircase: Plan, elevation and section of a boundary wall, Simple staircase and its components terminology. Types of stairs
6. Structural Details of Water Tank: Base slab, Top slab, Section Sump pit detail, Cover detail, General notes
7. Plumbing, sanitation, and Roof Drainage Plan of a Simple Building: Typical water supply system, Water and waste-water removal system, Roof drainage slopes, Standard Plumbing symbols, General notes
8. Electrical and HVAC Drawings of a Simple Buildings: Typical layout of electrification Symbols used. for electrical layout, Typical layout of HVAC Symbols used. for HVAC layout, General notes

Recommended Texts

1. Siddiqi, Z. A. (2016). *Basics of Engineering Drawing*. Lahore: M/S Technical Publishers.

Suggested. Readings

1. Horchsel, R. P. (2002). *Engineering Drawing and Geometry*. Hoboken: John Willy & Sons.

CE-112 Civil Engineering Drawing LAB 3 (1+2)

In civil engineering discipline, the engineer or designer working on a specific project must be able to communicate his or her design requirements to the contractor who is going to build the structure. The most effective way for a contractor or designer to produce set of drawings which clearly and unambiguously set out the structure. The drawing is the language of an engineer expressed. by the line. The shape intensity and texture are the alphabets of the drawing language. The aim of this lab is to practice the students about conversion of 3D objects to 2D drawings and the development of 3D object by using 2D drawings. They also practice to provide all the necessary information like lettering dimension etc.in an appropriate way. After the completion of this lab the students will be able to understand and interpret the information provided. in 2D drawing. It also focuses to provide the students with knowled.ge of principles and techniques of manual construction drawing. They will be able to construct the structures at the site properly.

Contents

1. Gothic lettering,
2. Basic curves and polygons
3. Isometric views,
4. Orthographic views (first and third angles)
5. Sections
6. Architectural plan, elevation, and section of a simple building
7. Structural details of a simple building
8. Architectural and structural details of a boundary wall
9. Architectural and structural details of staircase
10. Structural details of a water tank.
11. Plumbing, sanitation, and roof drainage plan of a simple building
12. Electrical and HVAC drawings of a simple building

Recommended Texts

1. Siddiqi, Z. A. (2016). *Basics of Engineering Drawing.* Lahore: M/S Technical Publishers.

Suggested. Readings

1. Horchsel, R. P. (2002). *Engineering Drawing and Geometry*. Hoboken: John Willy & Sons.
2. *ACI, Detailing Manual*

CE-113 **Basic Electro-Mechanical Engineering** **4 (2+2)**

The main aim of this course is to enable students to acquire basic knowled.ge of electrical and mechanical engineering relevant to civil engineering. This Course focuses on the interaction of electrical and mechanical systems as a whole and how the two systems interact with each other. This process is especially prominent in systems such as those of DC or AC rotating electrical machines which can be designed. and operated. to generate power from a mechanical process (generator) or used. to power a mechanical effect. After completing this course students will be able to apply knowled.ge of heat ventilation and air conditioning while designing a building. This subject also provide basic knowled.ge of electronics fundamentals of heat transfer, conduction, convection, radiation thermal conductivity and overall heat transfer coefficients. This course also introduces the basic concepts of power installation, distribution process. This course also covers the basic principles involve in house wiring and industrial wiring

Contents

1. Introduction to magnetic circuits
2. DC Motors: Working principle, construction, operation, parts, types, and characteristics.
3. Speed. Control of DC Motor: voltage and field current control method, effects of open field.
4. DC Series Motor: Torque, applications, terminal characteristics, methods for speed. Control.
5. DC Generator: Types, equivalent circuit, characteristic and voltage build-up phenomenon
6. Armature Reaction: Concept, causes, components, effects and remedies.
7. Commutation: Commutation process, difficulties, Ldi/dt effect, interposes.
8. Losses: Types, formulation, power flow diagram, efficiency and calculations.
9. Armature Winding: Parameters, multiplex windings, lap winding, wave winding, Transformer: Principle, operation, types, construction and applications.
10. Transformer Equivalent Circuit and Phasor Diagram
11. Transformer Tests and Voltage Regulations: Open and short circuit test, voltage regulation.
12. Auto Transformer: Basic principle, construction and working, voltage and current relationship,
13. Three Phase Transformers: Types, ratings, different type of connections.
14. Introduction to AC Machines: Types, parts, Nature, reversal and speed. of revolving magnetic field. Induction Motor: Construction, working, principle, torque,
15. Speed. Control of Induction Motor and Starting
16. Tests on Induction Motor: No load test, blocked. rotor test, resistance test and calculations.
17. Induction Generator: Principle, working and construction, Voltage build up and its applications.
18. BLDC, Switched. Reluctance, Hysteresis & Servo Motors: Construction, working and application.

Recommended. Texts

1. Stephen J. C. (2012). *Electric Machinery Fundamental*. New York: McGraw- Hill.

Suggested Readings

1. Fitzgerald, A. E. (2005). *Electric Machinery*. New York: McGraw-Hill.
2. Charles, I. Hubert, P.R. (2001). *Electric Machines: Theory, Operating Applications, and Controls*. NJ: Prentice Hall.

CE-114 Basic Electro-Mechanical Engineering LAB 4 (2+2)

The objective of the Electrical Machines Laboratory is to portray the concepts of DC and AC machines to students. As far as DC machines are concerned. It deals with working principle of DC machines and different types including operation as generator and motor. Additionally, it aims to impart knowled.ge on construction, performance and principle of operation of AC machines covering single phase and three phase transformers, synchronous and asynchronous machines and analyze their performance. After performing these laboratory work students will be able to apply knowled.ge of heat ventilation and air conditioning while designing a building. This lab work also provides basic knowled.ge of electronics fundamentals of heat transfer, conduction, convection, radiation thermal conductivity and overall heat transfer coefficients. This course also introduces the basic concepts of power installation, distribution process. This course also covers the basic principles involve in house wiring and industrial wiring. Students will also learn about 3 phase transformers and its various connections star/star, star/delta, delta/star and delta/delta.

Contents

1. Introduction to working principle of dc machine and its various parts
2. Determine armature and field resistance of a dc shunt generator and study its open circuit characteristics.
3. Perform the load test of a DC shunt generator.
4. Perform the load test of a DC series generator.
5. Perform the load test of a DC compound generator.
6. Determine torque speed. Characteristics of a DC series motor.
7. Analyze torque speed. Characteristics of a DC shunt motor.
8. Analyze torque speed. Characteristics of a DC compound motor.
9. Open circuit and short circuit test on single phase transformer and determine parameters of its equivalent circuit
10. Study 3 phase transformers and its various connections star/star, star/delta, delta/star and delta/delta.
11. Perform the block rotor or short rotor test on single phase induction motor.
12. Study no load and short circuit test on three phase alternators and draw open and short circuit characteristics.
13. Determine voltage regulation of an alternator by zero power factor method.
14. Find out synchronization of an alternator with an infinite bus by dark lamp method.

Recommended Texts

1. Stephen J. C. (2012). *Electric Machinery Fundamental*. New York: McGraw- Hill.

Suggested Readings

1. Fitzgerald, A. E. (2005). *Electric Machinery*. New York: McGraw-Hill.
2. Charles, I. Hubert, P.R. (2001). *Electric Machines: Theory, Operating Applications, and Controls*. NJ: Prentice Hall.

CE-115 Civil Engineering Materials 3 (2+1)

Civil engineering materials explains why construction materials behave the way they do. It covers the construction materials content for undergraduate courses in civil engineering and related. subjects and serves as a valuable reference for professionals working in the construction industry. This subject only gives a brief description about different types of materials used. in building construction for members like foundation, masonry, arches, lintels, balcony, roof, floor, doors, windows, stairs, plastering, painting and other general topics. Properties of various construction materials, their uses and different applications are discussed. in this subject. It provides information about all the building materials generally used. its types, properties and uses. Thus, this subject becomes necessary for civil engineers to learn about basic construction materials. Civil engineering materials are key components to the design and maintenance of civil structures. Most of these structures are large in scale such as bridges, buildings, and dams. Materials that are widely used. in the civil engineering practice include reinforced. concrete, asphalt, masonry, wood, structural steel, aluminum, and polymers.

Contents

1. Materials and properties: Introduction of materials, Construction materials, Physical properties,
2. Stone: Introduction, Types, Applications, Characteristics of good building stones, artificial stones
3. Cement and Lime: Introduction and manufacture of Ordinary Portland cement, Constituents of cement, Types of cement
4. Fine and coarse aggregates: Definition and Introduction of aggregates, Mechanical properties of aggregates, Physical properties of aggregates, Importance and methods of grading of aggregates
5. Cementitious materials: Introduction about mortars, Methods of preparation of mortars,
6. Ceramics and Bricks: History and evolution of ceramics, Manufacture of ceramics, Properties.
7. Plastics: Structure of plastics, Polymer technology, Types, Properties, Use of plastics
8. Glass: Constituents of glass, Methods of manufacture, Types, Use and significance
9. Wood: Structure of tree, General characteristics, Types, Seasoning of wood, Preservation of wood,
10. Paints: Objectives, Composition, Types, Consideration in choosing a particular paint,
11. Metals: Introduction about metals, Non-ferrous metals: Aluminium, Copper, Zinc, Lead, Nickel, Ferrous metals: Iron, Cast iron and steel, Manufacture of steel, Types of steel
12. Thermometry and acoustics: Mode of Heat transfer in buildings, Thermal conductivity
13. Miscellaneous Construction Materials: Asbestos, Plaster of Paris, Abrasives, Rubber , Cork, Bitumen, Asphalt, Road metal

Recommended Texts

1. Smith, R. C. & Andres, C. K. (1987). *Materials of Construction.* Glencoe: McGraw Hill.
2. Ed.ward, A & Joseph, I (2013). *Fundamental of Building Construction Materials and Method*. USA: John Wiley & Sons. NY

Suggested Readings

1. Duggal, P. & S. K. (2010). *Building Materials*. New Delhi, India: New Age International.

CE-116 Civil Engineering Materials Lab 3 (2+1)

The modern civil engineer needs to deal with traditional construction materials as well as advanced. materials Traditional construction materials, such as timber, steel, asphalt and Portland cement concrete are often used. in many construction projects. Modern materials, such as polymers and composites are making headway into the construction industry. Significant research on these materials has led. to better understanding of these materials and improved. their strength and durability performance. The traditional materials used. today are far superior to those of the past, and new materials are being specially develop to satisfy the needs of civil engineering applications. To a civil engineer the performance of materials in structures and their ability to resist various stresses are of prime importance. This laboratory experimental work is intended. to help students in civil engineering to understand the physical and structural properties of common construction materials. This involves the study of Portland cement concrete and concrete making materials (cement, aggregates, etc.), asphalt concrete, steel and timber, with minor reference to other advanced. materials.

Contents

1. To determine consistency, initial and final setting time of various samples of cement and then to discuss the results.
2. To determine the hydraulic properties of lime.
3. To determine different densities of coarse aggregate.
4. To carry out sieve analysis of various samples of coarse aggregates, draw gradation curves for those and to discuss its effects on the properties of concrete.
5. To determine different densities of fine aggregate.
6. To carry out sieve analysis of various samples of fine aggregates, draw gradation curves for those and to discuss its effects on the properties of concrete.
7. To determine the compressive strength of mortar with various mix ratios.
8. To determine water absorption of bricks and to discuss the results.
9. To determine compressive strength of bricks and to discuss the results.
10. To identify various types of wood samples by observation
11. To determine flexural strength of provided. samples of timber.

Recommended Texts

1. ASTM. *ASTM Standards*. Philadelphia: American Society for Testing Materials
2. Ed.ward, A & Joseph, I (2013). *Fundamental of Building Construction Materials and Method*. USA: John Wiley & Sons.

Suggested Readings

1. Duggal, P. & S. K. (2010). *Building Materials*. New Delhi, India: New Age International.

ENG-117 **Functional English** **2 (2+0)**

English is the language of science, of aviation, computers, diplomacy, and tourism. It's also the language of international communication, the media and the internet, so learning English is important for socializing and entertainment as well as work. The main aim of the subject is to increase the reading, writing and listening skills of the students. The ability to fluently speak English in addition to your native language can be beneficial if you're seeking job opportunities with international companies. Many employers prefer or require English speaking and writing proficiency. Job interviews for international business positions are often conducted. in English. The ability to speak this more universal business language can place you a step ahead of the competition. Most software programs are written in English. Those seeking to expand their computer knowled.ge can find the ability to read and understand the English language invaluable. Members of research teams need. a shared. Language to exchange ideas. English proficiency enables engineers and technicians to quickly adapt to new software tools of their company or the industry.

Contents

1. Speaking and Listening: Listening actively through the use of skills and sub skills, and in a variety of situations. Speaking: Fluency and confidence building through group discussions, role plays and public speaking.
2. Vocabulary development: Tips / strategies in vocabulary enhancement, Practice in vocabulary development
3. Reading: Reading skills, Sub skills, Reading strategies, Reading practice through variety of reading texts and comprehension exercises
4. Writing: Note taking: Techniques for taking notes from lectures, from books (integrated. with listening & reading).

Recommended Texts

1 Thmoas Bloor and Mariel Bloor. (2013). *The Functional Analysis of English*. (3rd ed.). London: Routled.ge.

Suggested Readings

1. Shafi, S., Mansoor, S. and Irfan, H. (1994). *Skill Worker: Student Activity Book: BA English for Paper B.*(1st ed.).Lahore: Caravan Book House Lahore

MATH-118 **Applied Calculus** **3 (3+0)**

Applied. calculus introduces the basic concepts of calculus with applications to business, life Sciences, and social Sciences and engineering. Concepts of Limits, differentiation, and integrations will be introduced. for polynomial, rational, exponential, and logarithmic functions. An introduction to functions involving several variables and partial derivatives will be included. Applications of business, life sciences, and social sciences and engineering will be extensively developed. Students will utilize a graphing calculator throughout the course. The main aim of the subject is develop students' problem solving skills using the techniques of calculus through numeric, analytic, graphical, and symbolic approaches. The course includes an introduction to exponential and logarithmic functions, limits, derivatives, maxima/minima, and Lagrange multipliers, and applications from business, economics, and finance. Problem-solving with mathematical software will also be emphasized. This course also covers the hyperbolic and trigonometric identities and their relationship, Rectangular and polar co-ordinate systems in three dimensions, Divergence and calculation for curl of a vector Field.

Contents

1. Complex Numbers: Basic Operations, Graphical Representations, Polar and Exponential Forms
2. Limits and Continuity: Introduction to Limits, Rates of Change and Continuity
3. Differentiation: Definition and Examples, Relation Between Differentiability and Continuity, Equations of tangents and normal, Derivative as slope, as rate of change, Convexity and concavity and Points of inflexion
4. Integration: Indefinite Integrals, Definite Integrals, Area Between curves, Improper Integrals Riemann Sum, Fundamental Theorem of Calculus, Area Under the Graph of a Nonnegative Function and Area Between curves
5. Transcendental Functions: Inverse functions, Hyperbolic and trigonometric identities and their relationship and Logarithmic and Exponential Functions
6. Vector Calculus: Three Dimensional Geometry, Vectors in Spaces, Rectangular and polar co-ordinate systems in three dimensions, Direction cosines, Plane (straight line) and sphere and curl of a vector field
7. Analytical Geometry: Arc-Length and Tangent Vector, Lengths of curves, Radius of gyration and Fubini's Theorem for Calculating Double Integrals

Recommended Texts

1. Schaum's series. (2012). *Calculus*. (6th ed.). New York: VaSchaum's series.
2. Antom, H. (1995).*Calculus and Analytic Geometry*. (10th ed.). Hoboken: Hoboken: John Wiley and Sons.

Suggested Readings

1. Talpur. (1972). *Calculus and Analytic Geometry*.(1st ed.). Ferozsons.

PK. ST-119 **Pak Studies** **1 (1+0)**

Pakistan studies is a subject that aims at enhancing students' knowled.ge about history, culture and geography of Pakistan and to inculcate patriotism in the hearts of students so that they may become a good citizen. The subject is widely researched. in and outside the country, though outside Pakistan it is typically part of a broader South Asian studies or some other wider field. Pakistan Studies is one of the few heritage subjects. Moreover, the aim of the subject is that the students should not be molded. to become narrow-minded. and parochial. Aims of this subject should be to open the faculty to accept past follies and learn to rectify the mistakes. This course also develop vision of Historical Perspective, Government, Politics, Contemporary Pakistan, ideology of Pakistan. This subject also enables the students to study the process of governance, national development, issues arising in the modern age, posing challenges to Pakistan and Socio-Economics international relations.

Contents

1. Historical Perspective: Ideological rationale with special reference to Sir Syed. Ahmed. Khan,,Allama Muhammad Iqbal and Quaid-e-Azam Muhammad Ali Jinnah. Factors leading to Muslim separatism, People and Land,Indus Civilization, Muslim advent, Location and Geo-Physical features.
2. Government and Politics in Pakistan:Political and constitutional phases: 1947-58, 1958-71, 1971-77, 1977-88, 1988-99, 1999-2008, 2008-2013, 2013 – onward
3. Freed.om Movement and Pakistan Movement
4. Nationalism in South Asia and Two Nations Theory
5. Ideology of Pakistan
6. Contemporary Pakistan.
7. Economic institutions and issues,
8. Society and social structure, Ethnicity.
9. Foreign policy of Pakistan and challenges.
10. Futuristic outlook of Pakistan
11. Socio-Economic International Relations

Recommended Texts

1. Kazmi, M.R. (2018). *Pakistan Studies.* Oxford: Oxford University Press.
2. Qureshi, I.H. (1957). *The Struggle For Pakistan*. Karachi: The Board of editors.

Suggested Readings

1. Ikram Rabbani, M. (2005). A Comprehensive book of Pakistan studies. Lahore : The Caravan Book House.
2. Chawla, M. I. (2017). One belt one road summit 2017 and its implications for CPEC: an overview. South Asian Studies, 32(2), 277-284.
3. Burke, S. and Ziring, L. (1994). *Pakistan's Foreign Policy*. Karachi: Oxford University Press.

CE-121 **Elementary Surveying** **3 (2+1)**

The main aim of this course is to enable students to understand theory and practice of land surveying. This course covers linear measurements, leveling, compass and transit/theodolite, theory of errors, areas, stadia, coordinate geometry, state plane coordinates and standard map projections. It covers latitudes and departures, legal aspects of land surveying and public land surveys. This course will enable students in reading and preparing surveying maps. Students will become familiar with the link between field data collection and office data practices and will gain valuable field experience in the techniques associated. with topographic surveys, boundary surveys, and construction staking. In addition, students will develop skills to use modern survey instruments such as such as theodolites, electronic distance meters, electronic total stations, and optical alignment devices to gather any topographic information. Apart from this, students will also learn to develop maps or plan for representation of an area on horizontal plan.

Contents

1. Introduction: Introduction to land surveying, Definitions of basic surveying terms branches and their application, Instruments used.
2. Survey Techniques: Distance measurement techniques, Compass survey, Traversing and triangulation, Plane table surveying, Computation of areas and volumes by various methods, Tachometry, Theodolite survey
3. Modern Methods in Surveying: Principles of ED.M operation, ED.M characteristics, Total stations, field procedures for total stations in topographic surveys, Construction layouts using total station
4. Leveling and Contouring: Methods and types of levels, precise leveling, Methods and applications of contouring
5. Computations and Plotting: Maps and plans, plotting, contour maps, profiles, cross-sections, prismoidal formula, Computations of area and volumes by graphical analysis and use of surveying software

Recommended Texts

1. Wolf P. R. & Ghilani C. D. (2012). *Elementary Surveying-An introduction to Geometrics*, 13th ed. NJ: NJ: Prentice Hall.
2. Kavanagh, B. (2014). *Surveying principles and Application*, (9th ed.) NJ: Prentice Hall.

Suggested Readings

1. Kanetkar, T. P., Kanetkar, T. P., & Kulkarni, S. V. (1984). *Surveying and Leveling*. Maharashtra: Poona Vidhyarthi Griha Prakashan..
2. Irvine, W., *Surveying for Construction*,(4th ed.). New York: McGraw-Hill.
3. Davis, R. E., *Surveying Theory and Practice*, (7th ed.) New York: McGraw-Hill.
4. Russel, P. W. and Brinker, C., (1997), *Elementary Surveying*, 9th ed. New York: Harper Collins.

CE-122 **Elementary Surveying LAB** **3 (2+1)**

The main aim of this lab is to study and practice those experiments that are related. to the basic Surveying techniques being used. for different civil works. Also this lab enables to handle and use various basic surveying related. instruments. Measurements of horizontal distances, vertical distances. Horizontal angles and vertical angles are some key requirements for most of the surveying jobs. This lab aims to cover all these measurement requirements with the help of surveying instruments. At the end of this lab, students will be able to determine the relative position of any objects or points of the earth, distance and angle between different objects, develop methods through the knowled.ge of modern science and the technology and use them in the field and will solve measurement problems in an optimal way. Apart from this, students will also learn to develop maps or plan for representation of an area on horizontal plan.

Contents

1. Measuring of a building, by using Measuring Tape and Pacing.
2. Measurement of distance by ranging and chaining
3. Locating various objects by chain surveying and determine offsets
4. Study of various parts and temporary adjustment of prismatic compass
5. Measurement of bearings of sides of traverse with prismatic compass
6. Measurement of bearings of sides of building by prismatic compass
7. Study and temporary adjustment of Plane table
8. Locating given traverse by Plane Table surveying using Radiation Method
9. Locating given traverse by Plane Table surveying using Intersection Method
10. Locating given traverse by Plane Table surveying using Traverse Method
11. Study of various parts of automatic level.
12. Temporary adjustment of an automatic level
13. Determine the height, distance and angle measurement of two points by using automatic level
14. Determination of elevation of various points with automatic level

Recommended Texts

1. Wolf P. R. & Ghilani C. D., (2012). *Elementary Surveying-An introduction to Geometrics*, (13th ed.): NJ: Prentice Hall, USA.
2. Kavanagh, B., (2014), *Surveying principles and Application* (9th ed.). NJ: Prentice Hall

Suggested Readings

1. Irvine, W. (1995). *Surveying for Construction*, (4th ed.). New York McGraw-Hill
2. Davis, R. E. (1966). *Surveying Theory and Practice*, (7th ed.). New York: McGraw-Hill

CE-123 **Engineering Mechanics** **4 (3+1)**

The primary purpose of the study of the subject is to develop the capacity to predict the effects of force and motion while carrying out the creative design functions of engineering. This capacity requires more than a mere knowled.ge of the physical and mathematical principles of mechanics; also required. is the ability to visualize physical configurations in terms of real materials, actual constraints and the practical limitations which govern the behavior of machines and structures. One of the primary objectives in a mechanics course is to help the student develop this ability to visualize, which is so vital to problem formulation indeed. the construction of a meaningful mathematical model is often a more important experience than its solution. Maximum progress is made when the principles and their limitations are learned. together within the context of engineering application. The main aim of this course is to explain basic concepts of statics, force system, equilibrium of rigid bodies, beams, Geometrical properties of plane areas, kinematics, friction, work and Energy. The students will be able to solve problems using concepts of statics & Kinematics to analyze force systems.

Contents

1. Basic Concepts: Concepts of space, time, mass, velocity, acceleration and force. Scalar and vector quantities, Newton's laws of motion, Law of gravitation.
2. System of Forces: Force System, Resultant, and resolution of co-planer forces using parallelogram, triangle & polygon law and funicular polygon. Simple cases of resultant and resolution of forces in space
3. Equilibrium of Rigid Bodies: Conditions of equilibrium of co-planar forces, analytical and graphical formulations. Free body concept, conditions of support and attachment to other bodies, Support Reactions under different types of loading. Introduction to shear force and bending moment diagrams. Degree of restraint and static determinacy statically determinate problems especially of civil engineering importance, Equilibrium of two-force and three-force bodies.
4. Properties of areas: Geometrical properties of plane areas, first moment of area, centroid, second moment of area, principal axes, polar second moment of area and radius of gyration.
5. Friction: Coulomb's theory of friction. Problems involving friction on flat and curved. surfaces
6. Kinematics: Rectilinear and curvilinear motion. Dynamic equilibrium
7. Kinetics: Work, energy and power. Virtual work, formulation of equilibrium of coplanar force. Potential energy, energy criterion for equilibrium, stability of equilibrium, application to simple cases. Newton’s equation of motion

Recommended Texts

1. Hibbeler, R. C. (2013). *Engineering Mechanics- Statics and Dynamics* (13th ed.).NJ: Prentice Hall.
2. Ferdinand, P. B. and Russel Johnston, E. Jr. (2008). *Vector Mechanics for Engineers* (7th ed.). New York: McGraw-Hill Education.

Suggested Readings

1. Mariam, J. L. (2007). *Engineering Mechanics Statics and Dynamics*. Hoboken: John Wiley & Sons.

CE-124 **Engineering Mechanics LAB** **4(3+1)**

The primary purpose of the study of this lab is to develop the capacity to predict the effects of force and motion while carrying out the creative design functions of engineering. This capacity requires more than a mere knowled.ge of the physical and mathematical principles of mechanics; also required. is the ability to visualize physical configurations in terms of real materials, actual constraints and the practical limitations which govern the behavior of machines and structures. Indeed. the construction of a meaningful mathematical model is often a more important experience than its solution. Maximum progress is made when the principles and their limitations are learned. together within the context of engineering application. The main aim of this lab is to explain basic concepts of statics, force system, equilibrium of rigid bodies, beams, geometrical properties of plane areas, kinematics, friction, work and energy. The students will be able to solve problems using concepts of statics & kinematics to analyze force systems.

Contents

1 To determine the reaction of the simply supported. beam under various loadings
2 To determine the center of mass of various figures, cut out the wooden plank by experiment &calculations
3 To find the tension in various parts of a hanging rope loaded. at various points.
4 To determine the force acting in the tie and jib of a simple jib crane (Wall Crane).
5 To verify the principle of moment.
6 To verify law of friction between solid bodies and to find the coefficient of friction between wood and other materials.

Recommended Texts

1. Hibbeler, R. C. (2013). *Engineering Mechanics- Statics and Dynamics* (13th ed.). NJ: NJ: Prentice Hall.
3. Ferdinand P. Beer and E. Russel Johnston Jr. (2008). *Vector Mechanics for Engineers* (7th ed.). New York: McGraw-Hill Education.

Suggested Readings

1. Mariam, J. L. & Kraige, L. G. (2007). *Engineering Mechanics Statics and Dynamics* (6th ed.). Hoboken: John Wiley & Sons.
2. Singer, F. L. (1987). *Engineering Mechanics* (4th ed.). New York: Harper and Row Publisher.
3. Sheri D. Sheppard, Thalia Anagnos, Sarah L. Billington. (2017). *Engineering Mechanics Statics Modeling and Analyzing systems in equilibrium*", (1st ed.). Hoboken: Willey and Sons.

CE-125 **Engineering Geology** **2 (2+0)**

Geology is the study of earth, its constituent and its structure. It mainly deals with rock, its formation, types, stresses, deformation. It also explains on "Rock as building material" and its properties. Engineering geology is the application of the geological sciences to engineering projects. It helps to understand properties of different types of rocks, soils to be used. in construction and their applications in foundation works. It is aimed. at studying the geology of an area for the purpose of assuring that the geological factors regarding the location, design, construction, operation and maintenance of engineering works, are perfect for the project implementation. It is also done during post-construction and forensic phases of the projects. Engineering geologists provide geological and geotechnical recommendations, analysis, and design associated. with human development and various types of structures. Engineering geology is a promising subject for operational applications of geological knowled.ge. The future lies in this subject. Opportunities will increase for students specializing in this subject.

Contents

1. Introduction: Introduction to various branches of geology, Origin and internal constitution of the earth.
2. Rocks and Minerals, Structural Features: Main groups, Igneous, sedimentary and metamorphic rocks, Important minerals and ores, Rock cycle, Glaciers and glaciations Dip, strike, folds, faults, joints, unconformities conformable and un conformable series of strata, Effects of folding,
3. Weathering and Erosion, Volcanoes: Agents of weathering and erosion, Weathering classification, Cycle of erosion, normal, glacial and marine erosion, Land forms, Mass wasting, Formation of meanders and ox-bow lakes, Formation of volcanoes, Causes of volcanoes, Nature and types of volcanic eruptions
4. Landslides: Definition, causes of landslides, Classification of landslides, Preventive measures against landslides
5. Earthquakes: Definition and related. technical terms, Causes of earthquake, Classification of earthquakes, Earthquake or seismic waves, Mechanism of earthquake,
6. Tunneling: Engineering geology of tunnels, Geological survey prior to tunneling, Lining of tunnels and their section, Selection of tunnel site and its requirements.
7. Geological Survey Maps: Physical method of subsurface mapping, Exploratory geological surveys at engineering sites
8. Engineering Applications: Importance of geology for civil engineering projects, Role of geology in selection of sites for dams, reservoirs and pertinent geological investigations, Geology of foundations, cutting tunnels, highways, airfields and bridges

Recommended Texts

1 Blyth, F.G.H. (1984). *A Geology for Engineers*. Oxford: Butterworth-Heinemann,
2 Bell, (2006). *Engineering Geology*. Oxford: Butterworth-Heinemann

Suggested. Readings

1. Dimitri, P.L. & Krynine, (1957). *Principles of Engineering Geology & Geotechnics*. New York: McGraw-Hills.
2. Ali H Kazmi and M. Qasim Jan, (1997). *Geology and tectonics of Pakistan*. Alabama*:* Graphic Publishers

MATH-126 **Applied Differential Equation** **3 (3+0)**

This course introduces students to the theory of boundary value and initial value problems for partial differential equations with emphasis on linear equations. This course also introduce basic techniques pertaining to matrices, formulation/solution of differential equations and Fourier series. In mathematics, a differential equation is an equation that relates one or more functions and their derivatives. In applications, the functions generally represent physical quantities, the derivatives represent their rates of change, and the differential equation defines a relationship between the two. Such relations are common, therefore differential equations play a prominent role in many disciplines including engineering, physics, and economics. On the other hand, differential equations incorporate first and higher derivatives in them and they deal with all types of different functions. They help us analyze systems that undergo 'continuous change'. Many parameters in real life like speed., temperature, pressure, and power are not constant. This course also covers applications of the Second Order Differential Equations Spring mass problems, RLC circuits' Simple pendulum

Contents

1 Introduction to Differential Equations: Introduction, Definitions and terminology, Formulations, order, degree and the linearity of differential equation, Initial-value problems
2 First Order Differential Equations: Variables separable forms, Homogenous equations, Non-homogenous equations, Exact equations, Linear equations, Solution by substitutions,
3 Applications of First Order Des: Modeling with the first order differential equations, Orthogonal trajectories, Population dynamics
4 Higher Order Linear Differential Equations: Introduction and preliminary theory, Initial-value and boundary-value problems, Introduction to Complex numbers, Homogenous and non-homogenous equations, Method of undetermined. coefficients, Method of variation of parameters, Power series solution
5 Applications of the Second Order Differential Equations: Spring mass problems, RLC circuits Simple pendulum
6 Partial Differential Equations: Basic concepts, Vibrating string, Wave equation, Heat equation
7 Fourier Series:

Recommended Texts

1 Ervin Kreyszig. (2010). *Advanced. Engineering Mathematics*. (10th ed.). Hoboken: John Wiley and Sons.

Suggested Readings

1 Speigal M. R. (1965). *Theory and Problems of Laplace Transforms.*(Latest ed.). New York: McGraw-Hill.

CE-127 **Civil Engineering Construction & Graphics** **3 (1+2)**

In construction industry, the manual analysis and drafting been replaced. by the computer aided. tools. Cumbersome and laborious manual work which requires costly printing/drawing instruments and a lot of time to analyze, has now become quite easy and interesting computer aided. design and drafting. In view of new era, there is an urgent need. for development of such course which encourages the use of modern tool usage. The aim of this course is to demonstrate the basic concepts of computer aided. Program used. for the building modeling and design. This course focuses to produce the capabilities of student to independently prepare the building drawings and develop an ability to analyze and design structures by commercially used. computer packages. After the completion of this course the student will be able to easily use the computer aided. modern tools solving the complex engineering problems. This course also provide knowled.ge about Highway and Motorway structural detail, layout plan and sectional plan

Contents

1 Introduction to Contour Plan, Infrastructure Layout, Site Plan
2 Architectural details of a simple two storied. building
3 GF plan, FF plan, Roof & Mumty plan, Elevation, Longitudinal & Transverse Sections
4 Structural details of a simple two storied. framed. RCC building
5 Foundation plan, plinth beams, floor beams, slab reinforcement, staircase & water tank detail
6 Plumbing and Electrical details of a simple two storied. building
7 Water supply and sewerage details, electrical details, electrification for all plans
8 Structural details of Steel Roof Truss
9 Structural steel detail, framing plan, truss elevation, member cross-section, connections
10 Drawings and detailing of Hydraulic and Drainage Structures
11 Hydraulic and Drainage structures structural detail, layout plan, sectional plan
12 Drawing and detailing of Highway and Motorway
13 Highway and Motorway structural detail, layout plan, sectional plan
14 Computer Aided. Drawing & Modeling
15 Use of 2D and 3D CAD software, BIM

Recommended Texts

1. Gurcharan Singh. (2005). *Civil engineering drawing.* New Delhi: Standard Publishers Distributors

Suggested. Readings

1. G. Omura and B. C. Benton. (2016). *Mastering AutoCAD 2017 & AutoCAD LT 2017.* Hoboken: John Willy & Sons.

CE-128 Civil Engineering Construction & Graphics LAB 3 (1+2)

In construction industry, the manual analysis and drafting been replaced. by the computer aided. tools. Cumbersome and laborious manual work which requires costly printing/drawing instruments and a lot of time to analyze, has now become quite easy and interesting computer aided. design and drafting. In view of new era, there is an urgent need. for development of such course which encourages the use of modern tool usage. The aim of this lab is to demonstrate the basic tools of computer aided. programs used. for the building modeling and design. This lab focuses to produce the capabilities of student to independently prepare the building drawings and develop an ability to analyze and design structures by commercially use computer packages. After the completion of this lab the student will be able to easily use the computer aided. modern tools solving the complex engineering problems. This course also provides knowled.ge about Highway and Motorway structural detail, layout plan and sectional plan

Contents

1. Introduction to AutoCAD
2. Auto Cad basic commands
3. Infrastructure layout, and Site Plan
4. Architectural Details of a Simple Two Storied. Building
5. Structural Details of a Simple Two Storied. Framed. RCC Building
6. Plumbing and Electrical Details of a Simple Two Storied. Building
7. Structural Details of Steel Roof Truss
8. Drawings of Hydraulic and Drainage Structures
9. Drawings of Highway and Motorway

Recommended Texts

1. Gurcharan Singh. (2005). *Civil engineering drawing.* New Delhi: Standard Publishers Distributors

Suggested Readings

1. Omura, G. and Benton, B. C. (2016). *Mastering AutoCAD 2017 and AutoCAD LT 2017.* Hoboken: John Willy & Sons.

ISL-129 **Islamic Studies** **2 (2+0)**

Islamic Studies engages in the study of Islam as a textual tradition inscribed. in the fundamental sources of Islam; Qur'an and Hadith, history and particular cultural contexts. The area seeks to provide an introduction to and a specialization in Islam through a large variety of expressions (literary, poetic, social, and political) and through a variety of methods (literary criticism, hermeneutics, history, sociology, and anthropology). It offers opportunities to get fully introductory foundational bases of Islam in fields that include Qur'anic studies, Hadith and Seerah of Prophet Muhammad (PBUH), Islamic philosophy, and Islamic law, culture and theology through the textual study of Qur'an and Sunnah. Islamic Studies is the academic study of Islam and Islamic culture. It majorly comprises of the importance of life and that after death. It is one of the best systems of education, which makes an ethical groomed. person with the qualities which he/she should have as a human being. The basic sources of the Islamic Studies are the Holy Qur'an and Sunnah or Hadith of the Holy Prophet Muhammadﷺ. The learning of the Qur'an and Sunnah guides the Muslims to live peacefully.

Contents

1. Study of the Qur'an (Introduction to the Qur'an, Selected. verses from *Surah Al-Baqarah, Al-Furqan, Al-Ahzab, Al-Mu'minoon, Al-An'am, Al-Hujurat, Al-Saff*)
2. Study of the Hadith (Introduction to Hadith literature, Selected. Ahadith (Text and Translation)
3. Introduction to Qur'anic Studies
4. Basic Concepts of Qur'an
5. History of Quran
6. Basic Concepts of Hadith
7. History of Hadith
8. Kinds of Hadith
9. Uloom –ul-Hadith
10. Sunnah& Hadith
11. Seeratul-Nabi (PBUH), necessity and importance of Seerat, role of Seerah in the development of personality, Pact of Madinah, KhutbahHajjat al-Wada' and ethical teachings of Prophet (PBUH).
12. Legal Position of Sunnah
13. Islamic Culture & Civilization
14. Characteristics of Islamic Culture & Civilization
15. Historical Development of Islamic Culture & Civilization
16. Comparative Religions and Contemporary Issues
17. Impact of Islamic civilization

Recommended Texts

1. Hassan, A. (1990). *Principles of Islamic jurisprudence*. New Dehli: Adam Publishers.
2. Zia-ul-Haq, M. (2001). *Introduction to al-Sharia al-Islamia*. Lahore: Aziz Publication.

Suggested Readings

1. Hameed.ullah, M. (1957). *Introduction to Islam*. Lahore: Sh M Ashraf Publisher.
2. Hameed.ullah, M. (1980). *Emergence of Islam*. New Dehli: Adam Publishers.
3. Hameed.ullah, M. (1942). *Muslim conduct of state.* Lahore: Sh M Ashraf Publisher.

CE-211 Surveying and GIS-RS Applications 3 (2+1)

The main aim of this course is to acquire knowled.ge of control surveys and their use in advanced. branches of surveying. Whereas the previous surveying course (Elementary SurveyingCE-121) was oriented. to basics and site surveying, this course is oriented. to route surveying. It also includes a number of advanced. concepts in surveying. This course includes electro-optical instrumentation techniques and complex computations used. in surveying. The course covers land surveying and boundary laws, public land surveys, topographic mapping, horizontal and vertical curves, GPS survey technology, hydrographic Surveys, surveying astronomy and tunnel surveying. In addition, this course will enable students to apply principles of surveying and modern tools in related. field problems.

Contents

1. Highway and Railway Curves: Circular curves, deflections and chord calculations, Setting out circular curves by various methods , Compound curves, reverse, vertical, parabolic curves Computation of high or low point on a vertical curve, Design considerations, spiral curves, spiral curve computations, Approximate solution for spiral problems, super elevations
2. Construction Surveys: Introduction, horizontal and vertical control, Buildings, rail roads, Route surveys, Pipeline and other construction surveys
3. Hydrographic Surveys: Objectives of hydrographic survey and electronic charting, Vertical control, depth and tidal measurements, Position fixing techniques, Sounding plan, horizontal control
4. Control Surveys: Geodesy universal transverse Mercator grid system, Modified. transverse Mercator grid system, Lambert projection, Computations for lambert projection
5. Field Astronomy: Solar and stellar observations for position and azimuth determination
6. Photogrammetry: Introduction, Application of aerial and terrestrial photogrammetry, Stereoscopy
7. GPS surveying techniques and applications: Survey planning, initial ambiguity resolution, Vertical positioning
8. Tunnel Surveying, Introduction, Use of gyroscope

Recommended Texts

1. Wolf P. R. & Ghilani C. D., *Elementary Surveying – An introduction to Geomatics* (13th ed.). NJ: Prentice Hall.
2. Thomas, M. Lillesand & Ralph W. Kiefer, *Remote Sensing and Images Interpretation* (5th ed.). Hoboken: John Wiley & Sons.

Suggested Readings

1. Kavanagh Barry, *Surveying with Construction Applications* (7th ed.). New York: Pearson Education.

CE-212 **Surveying and GIS-RS Applications LAB** **3 (2+1)**

Use of geographical information systems and remote sensing in surveying is considered. as breakthrough in the field of geodetic survey and non-geodetic survey. The main aim of this lab is to practice advanced. surveying techniques using advanced. surveying equipment. This lab helps to develop skills of students to use modern day surveying equipment's. Road works and mapping require great level of accuracy that can only be achieved. by using modern day surveying techniques e.g. geographical information systems. Contents of this lab are designed. in such a manner that students will learn to use geographical information systems for preparation of different surveying maps. At the end of this lab, students will be able to draw and develop different types of maps that could be used. for civil engineering jobs. The Use of geographical information systems and remote sensing in development of maps will also be the essential part of this lab.

Contents

1. Carrying out of a road alignment project (Determination of NSL of road cross sections)
2. Carrying out of a road alignment project (Plotting of NSL and design levels in field book)
3. Carrying out of a road alignment project (Layout of design levels of road cross sections)
4. Study the different parts and temporary adjustment of theodolite
5. To measure the horizontal angle by using theodolite
6. To plot an open traverse (Direct Angles) using theodolite
7. To plot a closed. traverse using theodolite
8. To set out a simple curve by Rankine's method of Deflection angle using Theodolite
9. Find out distances in height on an uneven ground by using tachometry method
10. To draw contours on Plane Table sheet to show by direct method
11. To find the Co-ordinates and Elevation of a Point with GPS
12. Field work with Total Station

Recommended Texts

1. Wolf, P. R. & Ghilani C. D. (2012). *Elementary surveying-an introduction to geometrics*, (13th ed.), NJ: Prentice Hall.
2. Kavanagh, B. (2014), *Surveying principles and application* (9th ed.). NJ: Prentice Hall

Suggested Readings

1. Irvine, W. (1995), *Surveying for construction* (4th ed.). New York: McGraw-Hill
2. Davis, R. E. (1966), *Surveying theory and practice* (7th ed.). New York: McGraw-Hill

CE-213 **Mechanics of Solid-I** **3 (2+1)**

Mechanics of solids is the foundation unit in the study of mechanics of structures. This is the branch of continuum mechanics that studies the behavior of solid materials, especially their motion and deformation under the action of forces, temperature changes, phase changes, and other external or internal agents. Mechanics of Solids is a vast subject because of the wide range of solid materials available, such as steel, wood and concrete. In Civil Engineering, specifically behavior of structural members such as bars, beams, subjected. to different sets of loading and states of stresses are discussed. and the same are computed. as well. The objectives of this subject are to enable students to acquire fundamental understanding of the behavior of structural components commonly used. in engineered. structures develop skills to help them model and analyze the behavior of structural components subjected. to various loading and support conditions based. on principles of equilibrium and material constitutional relationships.

Contents

1. Stress, Strain and Mechanical Properties of Materials
2. Binary Theory
3. Deflection of Beams
4. Theory of Torsion
5. Stress and Strain Transformations

Recommended Texts

1. Pytel, A. & F. L. Singer, (1987). *Strength of Material*. New Yok: Harper & Row Publishers.
2. Hibbler, R. C. (2016) *Mechanics of Materials*. NJ: Prentice Hall.

Suggested Readings

1. Warnock, F. V., Benham, P. P. (1970) *Mechanics of Solids and Strength of Materials*, Pitman Publishing.
2. James M. Gere & Barry. J. Goodno, (2008) *Mechanics of Materials*, (7th ed.). Boston: Cengage Learning.
3. James M. Gere & Stephen P. Timoshenko. (1997) *Mechanics of Materials*, (4th ed.). Boston: Cengage Learning.

CE-214 **Mechanics of Solid-I LAB** **3 (2+1)**

The mechanics of solid is a vast subject because of the wide range of solid materials available, such as steel, wood, concrete, biological materials, textiles, geological materials, and plastics. A solid material can support a substantial amount of shearing force over a given time scale during a natural or industrial process or action. This is what distinctly distinguishes solids from fluids, because fluids also support normal forces which are those forces that are directed. perpendicular to the material plane across from which they act and normal stress is the normal force per unit area of that material plane. Shearing forces in contrast with normal forces, act parallel rather than perpendicular to the material plane and the shearing force per unit area is shear stress. Therefore, solid mechanics examines the shear stress, deformation and the failure of solid materials and structures. To a civil engineer the performance of materials in structures and their ability to resist various stresses are of prime importance. This laboratory experimental work is intended. to help students in civil engineering to learn the fundamentals regarding strength of materials and to enhance their skills of utilizing materials of appropriate strength for civil engineering projects.

Contents

1. To determine the compressive strength of cement.
2. To determine the tensile strength of cement.
3. To determine the yield strength, ultimate strength, rupture strength and percentage elongation of mild steel bar.
4. To perform the Izod impact test for the given metals.
5. To determine the modulus of elasticity of the given rectangular beam.
6. To determine the modulus of rigidity of the given specimen with circular cross-section.

Recommended Texts

1 ASTM, C. (1958). ASTM Standards. Philadelphia: American Society for Testing Materials.
2. Hibbler, R. C., (2016). *Mechanics of Materials*. NJ: Prentice Hall.

Suggested Readings

1. Duggal, P & S. K. (2010). *Building Material.* (4th ed.). New Delhi: New Age International.
2. Pytel, A. & F. L.Singer, (1987). *Strength of Material*. New Yok: Harper & Row Publishers.

IT-215 **Computer Programming** **3(1+2)**

Computer programming courses focus on helping students develop an understanding of computer networks, operating systems, algorithms, database systems and web design. Students in computer programming courses will become familiar with programming languages. This course provides problem solving and computer programming skills for students with no prior experience in the area of programming. This course also develops skills of computer programming and its applications in solving elementary civil engineering problems. This Course also covers the main portion of MATLAB. MATLAB is a high-performance language for technical computing. It integrates computation, visualization, and programming in an easy-to-use environment where problems and solutions are expressed. in familiar mathematical notation. Typical uses include: Math and computation, Algorithm development, Modeling, simulation, and prototyping, Data analysis, exploration, and visualization, Scientific and engineering. This Course also provide sound understanding of the use of MS Office with advanced. applications of MS Excel in civil engineering field.

Contents

1. Introduction to Programming
2. The Loop Control Structure
3. The Case Control Structure
4. Functions
5. Arrays and Strings
6. Programming Languages
7. Programming of Civil Engineering Problems
8. Miscellaneous
9. Introduction to MS Office with advanced. applications of MS Excel
10. Use of MATLAB

Recommended Texts

1. Gottfried. (1992). *BS Programming with Structured. Basics* (1st ed.). New York: McGraw-Hill.
2. Deitel & Deitel, T.R. Nieto. (1999). *Visual C++ 6*. NJ: Prentice Hall.

Suggested Readings

1. Stephen J. Chapman. (2016). *MATLAB Programming for Engineers* (6th ed.). Cengage Learning.

IT-216 **Computer Programming LAB** **3 (1+2)**

Computer programming courses focus on helping students develop an understanding of computer networks, operating systems, algorithms, database systems and web design. Students in computer programming courses will become familiar with programming languages. This lab provides problem solving and computer programming skills for students with no prior experience in the area of programming. This lab also develops skills of computer programming and its applications in solving elementary civil engineering problems. This lab also covers the main portion of MATLAB. MATLAB is a high-performance language for technical computing. It also integrates computation, visualization, and programming in an easy-to-use environment where problems and solutions are expressed. in familiar mathematical notation. Typical uses include: Math and computation, Algorithm development, Modeling, simulation, and prototyping, Data analysis design, exploration, and visualization, Scientific and engineering. This lab also provides sound understanding of the use of MS Office with advanced. applications of MS Excel in civil engineering field.

Contents

1. Introduction (Computer hardware and components, Numbers System, Conversion between bases)
2. Introduction (Integers, Unsigned. Integers, Signed. Integers, Number Representations and Ranges, ASCII Codes, Algorithms and Flowcharts)
3. Introduction to Programming Language C++ / VB & Input/output, Operators, Selection
4. Loop (For, while and do-while loops)
5. Functions in Programming Language C++ / VB

Recommended Texts

1. Gottfried. (1992). *BS Programming with Structured. Basics* (1st ed.). New York: McGraw-Hill.
2. Deitel & Deitel, T.R. Nieto, (1999) *Visual C++ 6*. NJ: Prentice Hall.

Suggested Readings

1. Stephen J. Chapman. (2016). *MATLAB Programming for Engineers* (6th ed.). Boston: Cengage Learning.

CE-217 **Engineering Economics** **2 (2+0)**

Engineering economics, previously known as engineering economy, is a subset of economics concerned. with the use and application of economic principles in the analysis of engineering decisions. As a discipline, it is focused. on the branch of economics known as microeconomics in that it studies the behavior of individuals and firms in making decisions regarding the allocation of limited. Resources Thus, it focuses on the decision-making process, its context and environment. It is pragmatic by nature, integrating economic theory with engineering practice. But it is also a simplified. application of microeconomic theory in that it avoids a number of microeconomic concepts such as price determination, competition and demand/supply. As a discipline though, it is closely related. to others such as statistics, mathematics and cost accounting. It draws upon the logical framework of economics but adds to that the analytical power of mathematics and statistics. This course also enables students enable students to perform economic analysis of different projects.

Contents

1. Fundamentals of Engineering Economics
2. Capital Financing and Allocation: Funding, funding agencies and planning commission, Capital Budgeting, allocation of capital among independent projects, Financing with debt capital, Financing with equity capital, Trading on equity, Financial leveraging
3. Business Organization and Industrial Relationship: Types of ownership, Types of stocks, partnership and joint companies, Banking and Specialized. cred.it institution
4. Linear Programming: Mathematical statement of linear programming problems, Graphic solution simplex procedure, Duality problem
5. Depreciation and Taxes: Depreciation concept, Economic life, Methods of depreciation, Profit and returns on capital, productivity of capital
6. Selection between Alternatives: Time value of money and financial rate of return, present value, future value and annuities, Rate of Return Analysis, Incremental analysis, Cost-benefit analysis

Recommended Texts

1. Chan, S. Park. (2012). *Fundamentals of Engineering Economics*. New Jersey: Pearson Education
2. DeGarmo, E. P. Sullivan, G. W. & Bontadelli, A. J. (1979). *Engineering Economy*. New York: Macmillan Publishing Company

Suggested. Readings

1. John; Agee H. M. & Case, E. K. (1984). *Principles of Engineering Economic Analysis.* Hoboken, New Jersey: John Wiley & Sons White

CE-218 Construction Engineering 3 (3+0)

The objective of this course is to familiarize students about different construction methodologies and equipment to be used. in carrying out a construction project. The proper use of appropriate equipment contributes to economy, quality, safety, speed. and timely completion of a project. Using appropriate project delivery method reduces risk and improves the likelihood of attaining project cost, quality, and schedule goals. To develop ability of students to carry out the construction projects according to drawings and specifications. The main purpose of teaching construction drawings and specifications is to provide the students with a graphic representation with specification of what is to be built. After completing this subject student will be able to engage in design of temporary structures, coordination of project design, systems design, cost estimating, planning and scheduling, company and project management, materials procurement, equipment selection, and cost control. With the emergence of integrated. Project delivery methods such as design-build construction, the role of the engineer is expanding the need. for trained. professionals that understand both aspects of the project delivery environment.

Contents

1. Construction projects and their types
2. Construction project delivery methods
3. Project goals and objectives, project categories
4. Construction Industry of Pakistan, its regulations, codes, standards
5. Construction sustainability
6. Construction equipment, productivity estimation of various heavy equipment
7. Construction equipment economics for analysis of owning and operating costs
8. Overview of maintenance and repair of construction equipment
9. Site selection and orientation of building
10. Excavation in different soils, stability of excavation, dewatering, shoring, bracing sheet piling
11. Protection of adjacent structures and waterproofing
12. Construction of different footings, piling works
13. PCC, RCC, design and use of formwork, temporary structures
14. Concreting horizontal members, ready mix concrete, mass concreting
15. Masonry work, wood work, finishing work (paint, tiling, marble, metal etc)
16. Planar and Non planar construction, Steel Construction
17. Retaining structures, Hydraulics structures, underwater structures, pavements
18. Introduction to advance construction (e.g. shortcreting, retrofitting etc)
19. Precast construction, tilt-up construction

Recommended Texts

1. Stephens, W. Nunnally. (2010). *Construction Methods and Management.* (8th ed.). NY: Pearson.
2. Metha, M., Scarborough W., Armpriest D. (2007). *Building Construction: Principles: Materials, and Systems.* NY: Pearson.

Suggested. Readings

1. Ed.ward Allen, (2009). *Fundamentals of Building Construction: Materials and Methods*. (5th ed.). NY: Pearson

MATH-219 **Numerical Analysis** **3 (3+0)**

Numerical analysis is the area of mathematics and computer science that creates, analyzes, and implements algorithms for solving numerically the problems of continuous mathematics. Such problems originate generally from real-world applications of algebra, geometry, and calculus, and they involve variables which vary continuously. These problems occur throughout the natural sciences, social sciences, medicine, engineering, and business. This course introduces these basic concepts. The foundational role of set theory and its mathematical development have raised. many philosophical questions that have been debated. since its inception in the late nineteenth century. In particular, mathematicians have shown that virtually all mathematical concepts and results can be formalized. within the theory of sets. The formal academic area of numerical analysis varies from highly theoretical mathematical studies to computer science issues involving the effects of computer hardware and software on the implementation of specific algorithms. It also provides platform to introduce various techniques for solving linear, non-linear and difference equations using various numerical methods.

Contents

1 Solution of Non-Linear Equations: Bisection method, Newton's method, Secant method, Method of false position, Method of successive approximation
2 Interpolation: Basic idea, Taylor’s polynomial, Lagrange's formula of interpolation
3 Numerical Differentiation and Integration: Numerical differentiation, Review of integration concept and their physical significance for Engineering, Trapezoidal and Simpson's rule numerical integration techniques
4 Solution of Linear Simultaneous Equations:Gaus Elimination and Gaus-Jordan methods, Numerical solution of differential equations, Euler and modified. Euler methods, Runge-Kutta methods
5 Complex Numbers: Basic operations, Graphical representations, Polar and exponential forms of complex numbers, De’Moivre’s theorem with applications
6 Complex Variables: Limit, continuity, zeros and poles, Cauchy-Reimann Equations
7 Use of Softwares: Matlab, Mathmatica

Recommended Texts

1 Chan S. Park, Murray R. Spiegel. (2009). *Complex Variables*. NY: McGraw-Hill Education

Suggested Readings

1 Scheid, *Numerical Analysis.* (1989). NY: McGraw-Hill Education

CE-221 **Fluid Mechanics** **4 (3+1)**

The flow of fluids is important in many applications ranging from blood flow in the human body to the air flow over the wing of a jet aircraft and water flowing in pipes, canals and rivers. As a result, fluid mechanics is not only the providence of the civil engineer, but is truly a multi-disciplinary field attracting researchers in mechanical engineering, chemical engineering, materials science, petroleum engineering, environmental science, meteorology, geology, and astronomy. This course will help students in understanding the nature of fluid statics, in particular dealing with problems related. to hydrostatic forces and to analyze the problems related. to elementary fluid dynamics especially for incompressible flows using Bernoulli equation in particular. Students will characterize and determine the forces resulting from the interaction of flow with immersed. bodies. In addition this course will enable students to learn about forces on pressure conduits, reducers and bends, stationary and moving blades, Torques in rotating machines

Contents

1. Introduction: Solids and fluids (liquids and gases), Units and dimensions, Physical properties of fluids; density, specific weight, specific volume, specific gravity, surface tension, compressibility, Viscosity and its measurement, Newton's equation of viscosity, Hydrostatics, Kinematics, Hydrodynamics,
2. Fluid Statics: Pressure intensity and pressure head, Pressure and specific weight relationship, Absolute and gauge pressure,
3. Forces on Immersed. Bodies: Forces on submerged. planes & curved. surfaces and their applications
4. Buoyancy and floatation, Equilibrium of floating and submerged. bodies.
5. Fluid Kinematics: Steady and unsteady flow, Laminar and turbulent flow, Uniform and non-uniform flow,
6. Hydrodynamics: Different forms of energy in a flowing liquid, Bernoulli's equation and its application
7. Energy line and Hydraulic Gradient Line, Introduction to density currents, free and forced. vortex
8. Forces on pressure conduits, red.ucers and bends, stationary and moving blades, Torques in rotating machines.
9. Flow Measurement: Orifices and mouthpieces, sharp-crested. weirs and notches, Pitot tube and pitot static tube, Venturimeter, orificemeter.
10. Steady Flow through Pipes, Darcy-Weisbach equation for flow in pipes, Losses in pipe lines,
11. Uniform Flow in Open Channels: Chezy's and Manning's equations, Bazin's and Kutter's equations, Most economical rectangular and trapezoidal sections.

Recommended Texts

1. Daugherty, R. L., J. B. Franzini and Finnemore (2001). *Fluid Mechanics with Engineering Application.* NY: McGraw-Hill
2. Monson Young. (2010). *Fundamentals of Fluid Mechanics*. NY: McGraw-Hill

Suggested Readings

1. Douglus. (2011). *Fluid Mechanics* (6th Ed.). NY: McGraw-Hill

CE-222 **Fluid Mechanics LAB** **4 (3+1)**

Fluids are an integral part of our day-to-day life. Engineering allows us to explore the potential of fluids for a number of new applications and various functions. The history of fluid mechanics, the study of how fluids moves and forces them, dates back to ancient Greeks. The main aim of this subject is the study of forces on all kinds of fluids (liquids, gases) to obtain the various parameter information and to observe their behavior and properties. In civil engineering, Fluid mechanics subjects helps students to understand the behavior of fluids under various forces and at different atmospheric conditions, and to select the proper fluid for various applications. In this particular lab explains the basics of fluid mechanics in civil engineering applications and enables students to perform different experiments related. to fluid statics, fluid kinematics, fluid dynamics, flow measurement, steady flow through pipes and uniform and non-uniform flow in open channels.

Contents

1 To determine physical properties of a fluid.
2 To determine the metacentric height and locate the positions of various important points of a floating body.
3 To determine hydrostatic force on a submerged. plane surface and depth of center of pressure
4 To verify the Bernoulli's theorem for steady flow of water.
5 To determine the hydraulic coefficients of an orifice.
6 To determine the coefficient of discharges for rectangular Notch
7 To determine the coefficient of discharges for triangular Notch

Recommended Texts

1 ASTM, *ASTM Standards*. Philadelphia: American Society for Testing Materials
2 Linsley, R. K.Franzini, J. B., Freyberg (1979) .*Water resource engineering*. (3rd ed.). NY: McGraw-Hill, Inc.

Suggested Readings

1 Douglus. (2011). *Fluid Mechanics*. (6Th ed.). Canada: Pearson

CE-223 **Soil Mechanics** **4 (3+1)**

The main aim of this course is to acquaint students with the branch of science dealing with structure, engineering properties and reactions (behaviour) of soils under loading, weathering and varying environmental conditions i.e. Soil Mechanics. It studies soils theoretically and practically for building of structures using it and over it using knowled.ge of physics, mechanics, and hydraulics applied. to study the behavior. The science deals with the physical properties of soils and the relevance of these properties as they affect soil strength, stability, and drainage. This course is aimed. to establish a sound understanding of mutual interaction of soils and structures with the help of Soil Mechanics as it is the basis for all geotechnical applications, be it integrity of a structure or stability of a road or dam. Starting from origin of soil, the course covers the fundamental multi-phase nature of soils, provides an understanding of soil description and classification, stress related concepts, seepage, settlement and compaction problems.

Contents

1 Applications of soil mechanics in engineering practice
2 Types of soils and their properties. Formation of soils, structure of soil
3 Index properties of soil; weight-volume relationships, plasticity of soil
4 Engineering classification of soil; classification systems
5 Grain size distribution, hydrometric analysis, Atterberg's limits
6 Permeability; factors affecting permeability, Darcy's law, laboratory & field determination
7 Seepage; equipotential lines & flow nets estimation of seepage quantity & gradients
8 Stress distribution and shear strength; geostatic stresses, total stresses and pore pressure
9 Shear strength of cohesive and non-cohesive soils, coulomb's law
10 Laboratory and field tests for determination of shear strength
11 Settlement analysis; total &differential settlement, angular distortion, immed.iate settlement.
12 Primary and secondary consolidation settlements; normally and pre-consolidated. soils.
13 Mechanics of consolidation, theory of one dimensional consolidation
14 Determination of compression index and coefficient of consolidation,
15 Magnitude and time rate of consolidation settlement.
16 Determination of consolidation and elastic settlements.
17 Causes and methods of controlling settlement. Allowable total and differential settlement.
18 Soil compaction; mechanism, relative density, moisture density relationship, affecting factors
19 Compaction standards; control & measurement of in-situ density, field compaction equipment

Recommended Texts

1 Das, B. M. (1979). *Introduction to Soil Mechanics*. USA: Iowa State University Press.
2 Holtz, R. D, Sheahan, T. C. & Kovacs, W. D. (2010). *An Introduction to Geotechnical Engineering*. Canada: Pearson.

Suggested Readings

1. Whitlow, R. (2001). *Basic Soil Mechanics* (4th ed.). NJ: Prentice Hall.
2. Cernica, J. N. (1995). *Geotechnical Engineering.* Hoboken: John Wiley and Sons.
3. Qureshi, M. S. &Akber, A. (1997). *Fundamentals of Soil Mechanics* (2nd ed.). Pakistan: A-One Publishers.

CE-224 **Soil Mechanics LAB** **4 (3+1)**

Soil mass behaves variably in wetter and drier conditions, therefore assessment of engineering properties of soil upon which any foundation is to be laid is considered. as most basic part of civil works. The main aim of this lab is to carry out all the basic experiments related. to soil testing. Determination of properties of soil is an essential requirement to start any civil works e.g. road works and building works. Assessment of soil behavior upon loading can only be judged. by determining the basic properties of soil. This lab covers all such experiments that explain the engineering properties of soil mass individually. The tests covered. in this lab strictly adhere to the guidelines laid down by the American Society for testing and materials (ASTM) and American Association of state highway and transportation officials (AASHTO). Each designed. test method conforms to a specific code of ASTM or AASHTO or BS.

Contents

1. Sieve analysis.
2. Hydrometer analysis.
3. Specific gravity.
4. Moisture content determination.
5. Atterberg limits.
6. Field identification tests.
7. Permeability by constant and variable head.
8. AASTHO and modified. AASTHO test.
9. Density in situ by sand replacement and rubber balloon method.
10. Relative density

Recommended Texts

1 Das, B. M. (1979). *Introduction to Soil Mechanics*. USA: Iowa State University Press.

2 Holtz, R. D, Sheahan, T. C. & Kovacs, W. D. (2010). *An Introduction to Geotechnical Engineering*. Canada: Pearson.

Suggested. Readings

1. Whitlow, R. (2001). *Basic Soil Mechanics* (4th ed.). NJ: Prentice Hall.
2. Cernica, J. N. (1995). *Geotechnical Engineering.* Hoboken: John Wiley and Sons.
3. Qureshi, M. S. &Akber, A. (1997). *Fundamentals of Soil Mechanics* (2nded.). Pakistan: A-One Publishers.

CE-225 **Structural Analysis-I** **3 (3+0)**

The aim of structural analysis is to design a structure that has the proper strength, rigidity and safety. Structural analysis integrates the disciplines of mechanics, dynamics, and failure theories to compute the internal forces and stresses on the structures to be designed. Structured. Analysis is a development method that allows the analyst to understand the system and its activities in a logical way. It is a systematic approach, which uses graphical tools that analyze and refine the objectives of an existing system and develop a new system specification which can be easily understandable by user. It is graphic which specifies the presentation of application. It divides the processes so that it gives a clear picture of system flow. It is logical rather than physical i.e., the elements of system do not depend on vendor or hardware. It is an approach that works from high-level overviews to lower-level details. The primary purpose of the study of this subject is to explain stability and determinacy of structures (Beams, frames and truss etc) and to analyze different determinate structures (trusses, frames, arches, cables, three hinged. arches and beams) by various methods and effect of moving loads by influence line diagram.

Contents

1. Introduction to Structural Analysis: Types of structures, Structural idealization and loads, Red.undancy and stability of structures
2. Analysis of Determinate Pin Jointed. Structures: Method of joints, Method of sections, Method of moments and shears, Graphical method
3. Analysis of Statically Determinate Rigid Jointed. Plane Frames: Axial force diagrams, Shear force diagrams, Bending moment diagrams
4. Moving Loads, Influence lines for reactions, Shear force and bending moment in statically determinate beams and paneled. girders, Influence lines for member forces in pin jointed. frames, Calculation of maximum stress function (reaction, shear, bending moment, axial force) in these structures
5. Three Hinged. Arches, Cables and Suspension Bridges: Basic considerations in analysis and design, Moving loads on three hinged. arches and suspension bridge
6. Rotation and Deflection: Rotation and deflection of beams by moment area method, Conjugate beam method, Castigliano's second theorem, Rotation and deflection of plane trusses and frames, Principle of virtual work, unit load method, graphical method

Recommended Texts

1. Hibbler, R. C. (2016). *Structural Analysis* (9th ed.). NJ: Prentice Hall.
2. Wang, C.K.. (2017). *Intermediate Structural Analysis* (5th ed.). NY: McGraw-Hill.

Suggested Readings

1. LEET, K. M & Chia-Ming Uang. (2009). *Fundamentals Structural Analysis* (7th ed.).NJ: Prentice Hall.
2. West, H. (2002). *Fundamentals of Structural Analysis* (2nd ed.). New York: John Willey
3. N.J. Alexender Chajes. (1995).*Structural Analysis* (3rd ed.).NJ: Prentice Hall.
4. W. J. Spencer. (1988)*Fundamental Structural Analysis*. Palgrave MacMillon: New York, Inc.

MATH-226 **Probability and Statistics** **3 (2+1)**

Statistics and probability are sections of mathematics that deal with data collection and analysis. Probability is the study of chance and is a very fundamental subject that we apply in everyday living, while statistics is more concerned. with how we handle data using different analysis techniques and collection methods. This course deals with the laws governing random events, including the collection, analysis, interpretation, and display of numerical data. This course provides an elementary introduction to probability and statistics with applications. Topics include: basic combinatorics, random variables, probability distributions, Bayesian inference, hypothesis testing, confidence intervals, and linear regression. It also forms the fundamental basis for many other areas in the mathematical sciences including statistics, modern optimization methods and risk modelling. This course provides an introduction to probability theory, random variables. This course provide a foundation in probability theory and statistical inference in order to solve applied. problems and to prepare for more advanced. courses in probability and statistics.

Contents

1. Presentation of Data and Measures of Central Tendency: Classification, tabulation, classes, graphical representation, histograms, frequency polygons, frequency curves and their types Means: Arithmetic Mean (A.M), Geometric Mean (GM), Weighted. mean, median, quartiles, mode and their relations, Merits and demerits of Averages
2. Measures of Dispersion: Range, moments, skewness, quartile deviation, Mean deviation, Standard deviation, Variance and its coefficients
3. Curve Fitting and Regression: Goodness of fit, Scatter diagram, Fitting a straight line, Linear regression and correlation, Multiple regression
4. Probability and Random Variable: Definitions, sample space, events, Laws of probability, conditional probability, Dependent and independent events
5. Probability Distribution: Introduction, distribution function, Discrete random variable and its probability distribution (Binomial, Poisson), continuous random variable and its probability density function, uniform, and normal distribution functions, Mathematical expectation of a random variable
6. Introduction to Soft wares: Microsoft Excel, Matlab, SPSS

Recommended. Texts

1. McCuen, Richard. (1984). Statistical *methods for engineers* (1st ed.). USA: Prentice Hall

Suggested. Readings

1. Doughlas A Lind. (2006). *Basic statistics for business & economics* (5th ed.). NY: McGraw-Hill.

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MATH-227 **Probability and Statistics LAB** **3 (2+1)**

Statistics and probability are sections of mathematics that deal with data collection and analysis. Probability is the study of chance and is a very fundamental subject that we apply in everyday living, while statistics is more concerned. with how we handle data using different analysis techniques and collection methods. This lab deals with the laws governing random events, including the collection, analysis, interpretation, and display of numerical data. This course provides an elementary introduction to probability and statistics with applications. Topics include: basic combinatorics, random variables, probability distributions, Bayesian inference, hypothesis testing, confidence intervals, and linear regression. It also forms the fundamental basis for many other areas in the mathematical sciences including statistics, modern optimization methods and risk modelling. This course provides an introduction to probability theory, random variables. This lab provide a foundation in probability theory and statistical inference in order to solve applied. problems and to prepare for more advanced. courses in probability and statistics.

Contents

1. Introduction to Matlab including syntax
2. Simple program in Matlab
3. Solving CE problem using Matlab
4. Introduction to SPSS
5. Simple program in SPSS
6. Solving CE problem using SPSS
7. Simple program in Excel
8. Solving CE problem using MS Excel

Recommended Texts

1. McCuen, Richard. (1984). Statistical *methods for engineers* (1st ed.). USA: Prentice Hall

Suggested Readings

1. Doughlas A Lind. (2006). *Basic statistics for business & economics* (5th ed.). NY: McGraw-Hill.

CE-228 **Mechanics of Solid-II** **3 (2+1)**

The course is an extension and intensification of Mechanics of Solid-I. The goal of the course is to advance the understanding of structural behavior and enhance the ability to apply classical structural analysis methods to civil engineering systems. The advanced. methods for the analysis of structures will be applied. to some structural examples which will be developed. by the students. This course contains continuum mechanics of solids and its application to the mechanical response of structural elements such as beams, columns, thin and thick cylinders etc., elastic and elastic-plastic material models; torsion of thin tubes; failure criteria, analytical techniques and energy methods for elastic solids; implementing the finite element method for elastic solids. Understanding the mathematical and physical foundations of the continuum mechanics of solids, including deformation and stress measures, constitutive relations, and failure criteria and the basis for numerical methods in solid mechanics is the essence of this course.

Contents

1. Enhanced. topics related. to beam bending and shear
2. Theory of elasticity
3. Torsion of thin tubes and open sections
4. Cylinders
5. Theory of plasticity
6. Energy methods
7. Stability
8. Fatigue

Recommended Texts

1. Pytel, A. & F. L.Singer, (1987). *Strength of material*. New York.: Harper & Row Publishers,
2. Hibbler, R. C. (2010). *Mechanics of materials*. USA: Prentice Hall

Suggested Readings

1. Arthur P. Boresi. & Richard J. Schmidt, (2002) *Advanced mechanics of materials* (6th Ed.). Hoboken: John Wiley and Sons.
2. James M. Gere & Barry. J. Goodno, (2008). *Mechanics of materials* (7th ed.). CL Engineering
3. James M. Gere & Stephen P. Timoshenko, (1997) *Mechanics of Materials* (4th ed.). PWS Pub Co.
4. Zahid Ahmed. Siddiqi, (2015). *Mechanics of materials*. Lahore: Help Civil Engineering Publisher,

CE-229 **Mechanics of Solid-II LAB** **3 (2+1)**

This lab course is the continuation of Mechanics of Solid-I lab to further advanced. level The mechanics of solid is a vast subject because of the wide range of solid materials available, such as steel, wood, concrete, biological materials, textiles, geological materials, and plastics. The study of mechanics of solid often refers to various methods of calculating the stresses and strains in structural members, such as beams, columns, and shafts. The stresses and strains that develop within a mechanical member must be calculated. in order to assess the load capacity of that member. Once the state of stress and strain within the member is known, the strength of that member, its deformations and its stability can be calculated. therefore, solid mechanics examines the shear stress, deformation and the failure of solid materials and structures. To a civil engineer the performance of materials in structures and their ability to resist various stresses are of prime importance. This laboratory experimental work is intended. to help students in civil engineering to carry out analysis of complex state of stress and to familiarize them about the stability, analysis and failure modes of structural elements.

Contents

1. To determine torsion of bars with open and closed. cross sections.
2. To determine the buckling load under different conditions.
3. To verify the Euler's theory of buckling.
4. To perform bending of symmetrical and unsymmetrical cross-sections.
5. To determine elastic deformation of curved. beams.
6. To determine stresses under combined. bending and torsion.
7. To determine stresses in thin and thick wall cylinders.

Recommended Texts

1. Pytel, A. & F. L.Singer, (1987). *Strength of Material*. New York.: Harper & Row Publishers,
2. Hibbler, R. C. (2010). *Mechanics of Materials*, USA: Prentice Hall

Suggested Readings

1. Arthur P. Boresi. & Richard J. Schmidt, (2002) *Advanced. Mechanics of Materials*. (6^{th} Ed.). Hoboken: John Wiley and Sons.
2. James M. Gere & Barry. J. Goodno, (2008). *Mechanics of Materials*, (7th ed.). CL Engineering
3. James M. Gere & Stephen P. Timoshenko, (1997) *Mechanics of Materials*, 4th ed., PWS Pub Co.
4. Zahid Ahmed. Siddiqi, (2015). *Mechanics of Materials*. Lahore: Help Civil Engineering Publisher,

CE-311 **Advanced Fluid Mechanics** **4 (3+1)**

Advanced. fluid mechanics is the advance course offered. at undergraduate level in civil engineering. The course covers the topics related. to viscous flow, boundary layer theory, Impact of Jets and their applications including turbines and pumps. The students will go in more depth into the concepts of boundary layers, including free shear flows, pipe flow problems and hydrodynamics. The students will be able to apply the knowled.ge of laminar and turbulent flows to find pressure drop in pipes. The course will help in developing techniques useful for industrial applications of turbo machines. In addition this course will enable students to learn advanced. principles of fluid mechanics for broader application to civil engineering projects. Students will also learn about Flow around immersed. bodies: Lift and drag force, Boundary layer along smooth flat plate, Thickness of boundary layer, shear stresses and velocity distributions, Types of boundary layers (laminar, turbulent and laminar and turbulent), Friction drag coefficient.

Contents

1. Hydrodynamics Review: Ideal and real fluid, Differential equation of continuity, Rotational and irrational flow, Stream function and velocity potential function, Brief description of flow fields, Orthogonality of stream lines and equipotential lines, Flow net and its limitations, Different methods of drawing flow net.
2. Steady Flow through Pipes: Laminar and turbulent flow in circular pipes, semi empirical theories of turbulence, General equation for friction, Velocity profile in circular pipes, pipe roughness, Nukuradse’s experiments, Darcy-Weisbach Equation, Implicit and Explicit Equations for Pipe Friction Factor, Moody’s diagrams, Pipe flow problems, Minor losses, Branching pipes.
3. Flow around immersed. bodies: Lift and drag force, Boundary layer along smooth flat plate, Thickness of boundary layer, shear stresses and velocity distributions, Types of boundary layers (laminar, turbulent and laminar and turbulent), Friction drag coefficient.
4. Impact of Jets: Impulse momentum principle, Force of jet on stationary flat and curved. plates, Force of jet on moving flat and curved. plates, Forces of plumbing fittings.
5. Water Turbines: Types, impulse and reaction turbines, Centrifugal Pumps: Types, Classifications, Construction features, operation and efficiencies, Specific speed. and characteristic curves.
6. Reciprocating Pumps: Types, Maximum suction lift, construction features, specific speed. cavitation and operation.
7. Introduction to related. software.

Recommended Texts

1. Daugherty, R. L., J. B. Franzini and Finnemore, (1989). *Fluid Mechanics with Engineering Application*, NY: McGraw-Hill
2. Monson Young. (2010). *Fundamentals of Fluid Mechanics*. NY: McGraw-Hill

Suggested Readings

1. Douglus. (2011). *Fluid Mechanics* (6^{th} Ed.). NY: McGraw-Hill

CE-312 **Advanced Fluid Mechanics LAB** **4 (3+1)**

The main aim of this course is the study of advance form of the fluid mechanics course offered. at undergraduate level in civil engineering. The course covers the different types of flow such as laminar & turbulent flow viscous flow, Impact of Jets and their applications including turbines and pumps. The students will go in more depth into the concepts of boundary layers, including free shear flows, pipe flow problems and hydrodynamics. The students will be able to apply the knowled.ge of laminar and turbulent flows to find pressure losses in pipes. The course will help in developing techniques useful for industrial applications of hydraulic machinery. In addition to this, different lab experiments will be performed. related. to pipe flows, head losses in pipes, turbines and pumps. Students will also be able to learn about hydraulic machinery, its components and their functioning.

Contents

1. To observe laminar and turbulent flows using Reynold's Apparatus
2. To measure head loss in a pipe line of constant diameter.
3. To verify the Impulse Momentum Principle by using various deflectors
4. To perform experiment on Pelton wheel to plot its characteristics curves.
5. To make the study of Pelton wheel Turbine.
6. To make the study of Francis Turbine.
7. To perform experiment on Francis Turbine to plot its characteristics curves.
8. To perform experiment on Centrifugal Pump to plot its characteristics curves
9. To perform experiment on Double Acting Reciprocating Pump to determine the coefficient of discharge and slip of the pump.

Recommended Texts

1. Daugherty, R. L., J. B. Franzini and Finnemore (2001). *Fluid Mechanics with Engineering Application.* NY: McGraw-Hill
2. Monson Young. (2010). *Fundamentals of Fluid Mechanics*. NY: McGraw-Hill

Suggested Readings

1. Douglus. (2011). *Fluid Mechanics* (6th Ed.). NY: McGraw-Hill

CE-313 **Reinforced Concrete Design-I** **4 (3+1)**

Reinforced. Concrete Design-I is an introductory design course in civil engineering. This course includes revision of mechanical and durability properties of plain concrete as well as those of as reinforced. concrete. Basic structural elements such as beams, slabs, columns and footing, governed. by bending, shear, axial forces or combination of them are identified. and are considered. as building blocks of the whole structure. Different methods of design will be briefly described. before introducing the limit states of collapse and serviceability. The weakness of concrete in tension is compensated. by reinforcing materials such as steel bars which subsequently combines with stronger characteristic of concrete i.e. compression, to resist the external loads. Reinforcing schemes are generally designed. to resist tensile stresses in particular regions of the concrete that might cause unacceptable cracking and/or structural failure. From the simple beam to slab and further columns and other structural members designs are the constituent of the course.

Contents

1. Plain Concrete
2. Reinforced. Concrete
3. Structural framing and load calculations of a simple structure for gravity design
4. Slab analysis and design
5. Beam analysis and design
6. Columns
7. Footings
8. Concrete detailing

Recommended Texts

1. Hassoun, M. N. & Al-Manaseer, A, (2015). *Structural Concrete: Theory and Design*, (6th ed.). Hoboken: Wiley
2. Arthur H Nilson, David Darwin, Charles W. Dolan, Arthur Nilson, Charles Dolan, (2016). *Design of Concrete Structures*. (14th ed.) NY: McGraw-Hill

Suggested Readings

1. Chu-Kia Wang, Charles G. Salmon, José A. Pincheira, (2006), Reinforced. Concrete Design. (7th ed.). Hoboken: Wiley.
2. M. Neville, (2011), *Properties of Concrete*. (5th ed.). Hoboken: John Wiley

CE-314 Reinforced Concrete Design-I LAB 4 (3+1)

The most widely used. construction material is concrete, commonly made by mixing Portland cement with sand, crushed. rock, and water. Billion tons of concrete is going to use all over the world in a year due to its exceptional nature and properties the purpose of this lab is to understand the complete behavior of the plain and reinforced. concrete thorough various fresh and hardened. concrete tests. These tells will help to understand the various parameters of concrete and give an opportunity to examine its merits and demerits. Under the light of this knowled.ge the student will be able to critically think about the usage of various form of concrete. The design of various components of reinforced. cement concrete will also studied. in this lab. After the completion of this lab the student will have the sound knowled.ge of various parameters of plain and reinforced. concrete.

Contents

1. To study the compressive strength of concrete using cube and cylinder
2. To prepare mix design for various strengths of concrete
3. To find workability of concrete using slump cone method, compacting factor method, VeBe time method
4. To study the effect of w/c ratio on the strength of concrete
5. To study effect of aggregate/cement ratio of workability and compressive strength of concrete.
6. To determine the strength of concrete using core extraction and to discuss the results from control cylindrical samples
7. To study the ultrasonic pulse velocity test and Schmidt hammer test on hardened. concrete
8. To study the behavior of balanced. reinforced. under-reinforced. and over-reinforced. concrete flexural members
9. To study the behavior of shear deficient flexural members
10. To study the permeability of concrete samples with various mix ratio

Recommended Texts

1. Hassoun, M. N. & Al-Manaseer, A, (2015). *Structural Concrete: Theory and Design*, (6th ed.). Hoboken: Wiley
2. Arthur H Nilson, David Darwin, Charles W. Dolan, Arthur Nilson, Charles Dolan, (2016). *Design of Concrete Structures*. (14th ed.) NY: McGraw-Hill

Suggested Readings

1. Chu-Kia Wang, Charles G. Salmon, José A. Pincheira, (2006), Reinforced. Concrete Design. (7th ed.). Hoboken: Wiley.
2. M. Neville, (2011), *Properties of Concrete*. (5th ed.). Hoboken: John Wiley

CE-315 | **Structural Analysis-II** | **3 (3+0)**

This course is the continuation of Structural Analysis-I to further advanced. level. It is pertinent to mention here that structure refers to a system of connected. parts used. to support a load. Important examples related. to civil engineering include buildings, bridges and towers and in other branches of engineering, ship and aircraft frames tanks pressure vessels, mechanical systems and electrical supporting structures are important. Once a preliminary design of structure is proposed. the structure must then be analyzed. to ensure that it has its required. stiffness and strength. To analyze a structure properly, certain idealizations must be made as to how the members are supported. And connected. Together. The loadings are determined. from codes and local specifications, and the forces in the members and their displacements are found using the theory of structural analysis, which is the subject matter of this course. The objectives of this course are to learn and understand the classical methods of analysis for indeterminate structures under static and moving loads, familiarize students with various methods of analysis of indeterminate structures and develop the skills for using the state-of-the-art methods of structural analysis.

Contents

1. Analysis of Indeterminate Structures Using Force Approach
2. Analysis of Indeterminate Structures Using Displacement Approach
3. Matrix Methods
4. Finite Element Method

Recommended Texts

1. Hibbeler, R. C., (2011), *Structural Analysis*. (8th ed.). NJ: Prentice Hall.
2. Aslam Kassimali, (2014), *Structural Analysis*, (5th ed.). Boston: Cengage Learning

Suggested Readings

1. Wang, C. K., (1984), *Intermediate Structural Analysis*, NY: McGraw-Hill education
2. Rizwan, S.A., (2003), *Theory of Indeterminate Structures*. (2nd ed.).

CE-316 **Quantity and Cost Estimation** **3 (2+1)**

The objective of this course is to enhance the ability of students to learn the various principles of computations related. to quantity surveying. It develop skills that requires critical thinking and creative problem solving. Quantity surveying is more than just estimating costs and balancing budgets, it is about utilizing strategic methods to ensure a profitable, efficient and high quality construction. To enhance skill of students in preparing detail estimates and bill of quantities for various civil engineering projects. To familiarize students with tender/bid and contract documents that helps to get the best possible contractor for minimum price. This course introduces the types of cost estimation from the conceptual design phase through the more detailed. design phase of a construction project. In addition, the course highlights the importance of controlling costs and how to monitor project cash flow. Students will work on a break-even analysis of construction tasks in a civil engineering project.

Contents

1. Review of basic take-off mathematics and measurement units
2. Quantity take-off and Pricing of Labor and material
3. Pricing of equipment for site work, concrete, masonry, carpentry and finish work
4. Estimation procedures for concrete retaining wall, piles, steel truss
5. Estimation work for roads, sewer, pipe work
6. Maintaining of Measurement Books
7. Types and Methods of Estimates
8. Rate Analysis
9. Labor productivity, cost analysis of construction materials
10. Estimate setup, overhead, profit, escalation, contingency
11. Contractual Aspects related. to bidding
12. Specification and their types of various items of construction projects
13. Overview of payment schemes in construction projects
14. Preparation of tender/bid documents, evaluation methods
15. Bid submission, standard form of contract, scheduled. rates and specifications

Recommended Texts

1. Marks, K. Robert S. Weygant, H. J. R. & John R. R. (2010). *Construction specifications writing: principles and procedure.* (6th Ed.). Hoboken: Wiley.
2. Stephen J. Peterson. (2017). *Construction estimating using excel* (3rd Ed.) USA: Prentice Hall

Suggested Readings

1. Jimmie, H. (2013). *Construction contracts (*3rd ed.). NY: McGraw-Hill

CE-317 Quantity and Cost Estimation LAB 3 (2+1)

The objective of this lab course is to enhance the ability of students to perform the various computations related. to quantity surveying. It develops skills and enhances that requires critical thinking and creative problem solving. Quantity surveying is more than just estimating costs and balancing budgets, it's about utilizing strategic methods to ensure a profitable, efficient and high-quality construction. To enhance skill of students in preparing detail estimates and bill of quantities for various civil engineering projects. To familiarize students with tender and contract documents that helps to get the best possible contractor for minimum price. This lab work covers topics related. to the types of cost estimation from the conceptual design phase through the more detailed. design phase of a construction project. In addition, the course highlights the importance of controlling costs and how to monitor project cash flow. Students will work on a break-even analysis of construction tasks in a civil engineering project.

Contents

1. Use of spread sheet for estimation
2. Bill of quantity and abstract of cost of a building and road
3. Bill of quantity and abstract of cost of a sewer and water supply line
4. Rate analysis using spread sheet
5. Work on maintaining Measurement Book
6. Preparing tender document
7. Preparing bidding proposal
8. PEC contract document
9. Preparation IPC
10. Exposure to Real time project's pre-construction phase

Recommended Texts

1. Marks, K. Robert S. Weygant, H. J. R. & John R. R. (2010). *Construction Specifications Writing: Principles and Proced.ures.* (6th Ed.). Hoboken: Wiley.
2. Stephen J. Peterson. (2017). *Construction Estimating Using Excel*. (3rd Ed.) USA: Prentice Hall

Suggested Readings

1. Jimmie, H. (2013). *Construction Contracts",* 3rd ed., NY: McGraw-Hill

SOC-318 **Business Communication** **2 (2+0)**

To inculcate in students the skills of organizing material, writing a report, and presenting their work for business communication. Business communication is the process of sharing information between people within and outside a company. Effective business communication is how employees and management interact to reach organizational goals. Its purpose is to improve organizational practices and reduce errors. Business communication is used. to promote a product, service, or organization; to relay information within the business; or to deal with legal and similar issues. Business Communication is a practical course that will show you the right way to write memos, letters and reports. Lessons include techniques for writing informational, persuasive, sales, employment, and good and bad news communications, to both internal and external audiences – with practice analyzing those audiences. This course is designed. to give students a comprehensive view of communication, its scope and importance in business, and the role of communication in establishing a favorable outside the firm environment, as well as an effective internal communications program. The various types of business communication media are covered. This course also develops an awareness of the importance of succinct written expression to modern business communication. Many of the assignments are to be keyboarded.

Contents

1. Foundations of Business Communication: Definitions; communication, organization, Understanding the need. and scope of business, Professional and organizational communication, Conditions, properties, process, tools, modes, levels, types of communication.
2. Oral Communication: Group Discussions and interpersonal skills, Meetings, Interviews, Making presentations
3. Business & Technical Writing: Types of messages: Formats (Letter and memorandum) , Three . Types of Business Messages (routine, negative and persuasive communications), Organizational Plans: Direct, Indirect & AIDA approach. Writing business messages (e-mails, inquiries, requests, replies, regrets,] declining offers, letters, routine messages, etc.), Meetings: notice, \ agenda and minutes. Job applications and resumes. Research / scientific reports (structure, layout, writing process

Recommended Texts

1. Ellen, K. (2002). *Maximize Your Presentation Skills: How to Speak, Look and Act on Your Way to the Top, Prima Lifestyles.* Red.fern, New South Wales: Currency
2. Hargie, O. (2006). *Hand book of Communications Skills, UK: Routled.ge.*

Suggested. Readings

1. Mandel, S. (2000). *Effective Presentation Skills: A Practical Guide Better Speaking.* Hamilton Court Menlo Crisp Publications.

SOC-319 **Professional Ethics** **2 (2+0)**

It is essential for professionals in any field to have an understanding of the ethical problems and principles in their field. But anyone, no matter what their job, must deal with many other professions as well. Part of professional ethics is the understanding of the ethics of other professions: how they interact and what can be expected. from them as correct ethical behavior. In turn, any professional will benefit from a critical scrutiny of their own ethics by those from other professions. The general principles of professional ethics will be examined. as well as the distinctive problems of the different fields. The course is taught in six modules of four lectures and two tutorials each, covering the ethics of several major professions: Business Ethics, Media Ethics, Police Ethics, Medical Ethics, Legal Ethics, and Research Ethics. Topics covered. Will also include: the nature of a profession, professional codes of ethics, confidentiality, whistle-blowing, the responsibility of business to the environment, uses and abuses of human research, and animal ethics in research.

Contents

1. Introduction to Professional & Engineering Ethics: Definitions - Ethics, Professional Ethics, Engineering Ethics, Business Ethics; Ethics & Professionalism. Need. And scope of Engineering and Professional Ethics through Case Studies. Development of Engineering Ethics & Major issues in Engineering & Professional Ethics
2. Moral Reasoning &Ethical Frameworks: Ethical Dilemma: Resolving Ethical dilemmas and making Moral Choices. Codes of Ethics (of local and international professional bodies). Moral Theories: Utilitarianism, Rights Ethics and Duty Ethics, Virtue Ethics Self-Realization &Self Interest. Ethical Problem Solving Techniques: Line drawing, flow Charting, Conflict Problems. Case Studies and applications.
3. Contemporary Professional Ethics: Professional Responsibilities. Risk and Safety as an Ethical Concern for Engineers Workplace Responsibilities and Ethics: Teamwork, confidentiality and conflicts of interest, Whistle blowing, Bribe and gift, risk and cost - benefit analyses, gender discrimination and sexual harassment. Environmental Ethics. Computer Ethics &the Internet. Honesty: Truthfulness, trustworthiness, academic and research integrity, critique codes of ethics

Recommended Texts

1. Mike W. M. Roland S. (2004). *Ethics in Engineering*. (4th ed.) NY: McGraw-Hill
2. Charles E. H. Michael S. (2018). Engineering Ethics: Concepts and Cases. (6th ed.). Boston: Cengage Learning

Suggested Readings

1. Stephan R. C. (2015). *The Seven Habits of Highly effective people.* NY: McGraw-Hill

CE-321 **Environmental Engineering-I** **3 (2+1)**

The main aim of this course is the study of environmental engineering. Environmental engineering is the application of engineering principles under limits to the protection and enhancement of the quality of the environment and to protect and enhance the public health and welfare. Environmental engineers should have vast knowled.ge to deal with the structures, equipment's and systems that are designed. to protect and enhance the public health and welfare. The objective of this course is to introduce the concept of environmental pollution, contamination and its sources particularly in context to water and to learn principles of environmental engineering applied. to the design and implementation of water supply schemes. Upon successful completion of this course students will be very much familiar with water, its quality (water should be free from impurities and it's quality should be according to guidelines /standards) , demand of water for various purposes, services of water supply schemes and design of water distribution networks and treatment systems.

Contents

1. Introduction: Environmental Engineering, Water Engineering, Sanitary Engineering, Air & Noise Pollution
2. Water Pollution: Water chemistry and characteristics, Introduction to sources of pollution, Effects on water quality, Control parameters
3. Water Demand and Supply: Population forecast, Water uses & consumption, Types and variations in demand, Maximum demand & fire demand
4. Water Quality: Water impurities & their health significance, Water quality guidelines/standards (US., WHO and NSDW Pakistan etc.), Water quality monitoring
5. Water Sampling and Testing: Sampling techniques and examination of water (physical, chemical and microbiological parameters), Water borne diseases
6. Water Treatment: Treatment of surface & ground water, Screening, (types of settling), coagulation and flocculation , Filtration, Design aspects of slow sand and rapid sand filters and their operations, Pressure filters, Membrane Technology (Reverse Osmosis, Ultrafiltration)
7. Miscellaneous Water Treatment Techniques: Fluoridation, Iron & Manganese removal, Water softening methods, Water disinfection and chemicals, Chlorination, Emergency treatment methods, Ozone, Ultraviolet
8. Water Distribution: Layout and design of water transmission works and distribution networks (Hardy Cross and Equivalent Pipe method), Service reservoirs, Fixtures and their installation,
9. Use of relevant software in design

Recommended Texts

1. Mackenzie, L.D. and Cornwell, D.A. (2008). *Introduction to Environmental Engineering*. (4th ed.). NY: McGraw-Hill.
2. Peavy, H.S, Rowe, D.R. and Tchobanoglous, G. (1987). *Environmental Engineering.* (7th ed.). NY: McGraw-Hill Publishing Company.

Suggested. Readings

1. McGhee, T. J. and Steel, E. W. (1991). *Water Supply and Sewerage* (6th ed.). Europe: McGraw-Hill ed.ucation.

CE-322 Environmental Engineering-I LAB 3 (2+1)

The main aim of this course is the study of environmental engineering along with related. aspects such as economics, ecology. A qualified. environmental engineer must have vast knowled.ge of designing, construction and waste maintenance techniques to preserve the health of rural, sub-urban and urban areas. Industrialization of a place leads to increase in environmental pollution and other hazards which are a threat to mankind. The objective of this course is to introduce the concept of environmental pollution, contamination and its sources particularly in context to water and to learn principles of environmental engineering applied. to the design and implementation of water supply schemes. With rapid economic development it has come to realize the role of environmental engineers to check the environmental hazards and create an ecological balance so that life can carry on comfortably. In particular lab of environmental engineering students will be able to learn and perform experiments related. to water and wastewater quality according to defined. guidelines /standards.

Contents

1. To determine optimum dosage for turbid water by jar test.
2. To determine dissolved. Oxygen of a given water sample.
3. To determine Biological Oxygen Demand (BOD) of a given sample.
4. To determine the Chemical Oxygen Demand (COD) of a given sample
5. Determination of Coliform bacteria of a given water sample by Multiple Tube Fermentation method.
6. To determine the amount of nitrogen in a given sample.
7. Study of single beam Spectrophotometer.

Recommended Texts

1. Mackenzie, L.D. and Cornwell, D.A. (2008). *Introduction to Environmental Engineering*. (4th ed.). NY: McGraw-Hill.
2. Peavy, H.S, Rowe, D.R. and Tchobanoglous, G. (1987). *Environmental Engineering.* (7thed.). NY: McGraw-Hill Publishing Company

Suggested. Readings

1. McGhee, T. J. and Steel, E. W. (1991). *Water Supply and Sewerage* (6th ed.). Europe: McGraw-Hill ed.ucation.
2. Linsley, R. K., J. Franzini, *Water Resources Engineering*. (4th ed.) NY: McGraw-Hill

CE-323 **Reinforced. Concrete Design-II** **4 (3+1)**

This course is the continuation of Reinforced. Concrete Design-Ito further advanced. level. The purpose of this course is to keep students up to date with various advanced. mechanics and theories on reinforced. concrete structures and to develop your skills to conduct analysis and practical design of real-life RC structures. This course aims to give graduates with a sound background of the design of reinforced. concrete structures, an understanding of selected. Advance topics in the field including the use of new concepts, construction techniques and materials. The course also provides a revision of some of the fundamental principles of reinforced. Concrete design. In particular, the course addresses analysis and design of flat slab, flat plate, waffle slab, slender columns, foundations, stairs, water tanks, reservoirs etc. Analysis and design of prestressing concrete and basic introduction to earthquake resistant design of structures are the essence of this course. The major course learning outcomes are to explain concepts of analysis and design for reinforced. concrete members and design different reinforced. concrete members with different design approaches.

Contents

1. Flat slab, Flat plate and Waffle slab
2. Design of torsion
3. Slender columns
4. Design of different types of foundations
5. Stairs, water tanks, reservoirs
6. Prestressing principles and design philosophy
7. Introduction to earthquake resistant design of structures
8. Design of gravity and cantilever retaining walls

Recommended Texts

1. Hassoun, M. N. & Al-Manaseer, A, (2015). *Structural Concrete: Theory and Design*, (6th ed.). Hoboken: Wiley
2. Arthur H Nilson, David Darwin, Charles W. Dolan, Arthur Nilson, Charles Dolan, (2016). *Design of Concrete Structures*. (14th ed.) NY: McGraw-Hill

Suggested Readings

1. Chu-Kia Wang, Charles G. Salmon, José A. Pincheira, (2006), Reinforced. Concrete Design. (7th ed.). Hoboken: Wiley.
2. M. Neville, (2011), *Properties of Concrete*. (5th ed.). Hoboken: John Wiley

CE-324 **Reinforced. Concrete Design-II LAB** **4 (3+1)**

The designing of the various civil engineering structure is an important task of civil engineer. The stability, strength and serviceability are objective of structural design. The structure must be able to withstand the extreme service and environmental loads. The understanding of various service and environmental loads are very important for the civil engineering students. The aim of this lab is to develop the understanding of various design codes and its limitations. The component designing to overall designing of a complete structure will also be studied. in this lab. The development of structural drawings under the umbrella of various international codes will be studied. After the completion of this lab the student will be able to design a complete structure considering the various design codes and able to present his design through engineering language (set of drawings). The major course learning outcomes are to explain concepts of analysis and design for reinforced. concrete members and design different reinforced. concrete members with different design approaches.

Contents

1. To design various structures manually and to draw its structural drawings
2. To model, analyze and design various types of structures using FE based. softwares

Recommended Texts

1. Hassoun, M. N. & Al-Manaseer, A, (2015). *Structural Concrete: Theory and Design*, (6th ed.). Hoboken: Wiley
2. Arthur H Nilson, David Darwin, Charles W. Dolan, Arthur Nilson, Charles Dolan, (2016). *Design of Concrete Structures*. (14th ed.) NY: McGraw-Hill

Suggested Readings

1. Chu-Kia Wang, Charles G. Salmon, José A. Pincheira, (2006). Reinforced. Concrete Design. (7th ed.). Hoboken: Wiley.
2. M. Neville, (2011), *Properties of Concrete*. (5th ed.). Hoboken: John Wiley

CE-325 **Transportation Engineering-I** **3 (3+0)**

The main aim of this course is to provide background knowled.ge of transportation engineering with detailed. and thorough understanding of framework of various transportation systems. Transport engineering is the application of technology and scientific principles to the planning, functional design, operation and management of facilities for any mode of transportation in order to provide for the safe, efficient, rapid, comfortable, convenient, economical, and environmentally compatible movement of people and goods transport. Transportation engineering primarily involves planning, design, construction, maintenance, and operation of transportation facilities. Transportation Systems contains Physical "fixed." facilities: streets; roads; highways; railroads; airport; sea & river ports; pipelines and canals. Flow entities: fleets of vehicles; vessels and aircrafts. Control systems refer to the technological ways in which individual vehicles are guided. on fixed. facilities. They include means that permit the efficient safe and smooth operation of streams of vehicles and reduce conflicts between vehicles [Signing; Marking and signaling]. Explain the concepts of transportation systems and its planning. Carry out geometric design based. on best practices and guidelines.

Contents

1. Introduction to Transportation Systems and Planning: Modes of transportation, need. and scope of comprehensive plan, Phases of planning, Principles of planning, Communication (road network, rail-road network & airport), port and harbor facilities, Introduction to design aspects , Geometric Design, Overview of Mass Transit Systems
2. Railway Engineering: Elements of track ,Types of gauges, Types of rail sections, Rail joints, Creep and wear of rail, Fish Plate bearing plates and check rails, Types of sleepers, their merits and demerits, Sleeper density spacing and stiffness of track, Types of ballast, Requirements for good ballast, Renewal of ballast, Formation of single and double track, Formation failures, Selection of site for a railway station, Layout of stations and yards , Modern methods for construction of tracks, Maintenance, tools and organization, Introduction to design aspect, Points and crossings
3. Airport Engineering: Type &elements of Airport planning, Factors affecting Airport Site Selection, Airport Classification, Airport Drainage Systems, Various Runway Configurations, Introduction to design aspect, Instrument Landing Systems (ILS)
4. Ports and Harbour Engineering: Classification of harbours, Ports and harbours, Design principles and requirements of harbours, Wharves and jetties, Breakwaters and groynes, Channel regulation and demarcation, Types of docks and their construction, Transit shed.s and warehouses

Recommended Texts

1. Jason C. Yu, (1982). *Transportation Engineering Introduction to Planning, Design and Operations*. Elsevier Science Ltd.
2. Mannering, Fred., Walter Kilareski, and Scott Washburn. (2007). *Principles of highway engineering and traffic analysis*. Hoboken: John Wiley & Sons.

Suggested Readings

1. Horonjeff, R. (1993). *Planning and Design of Airports*. (4th ed.) NY: McGraw-Hill Professional;
2. Gregory P. Tsinker, (2004). Port *Engineering Planning Construction Maintenance and Security*, Hoboken: John Wiley

CE-326 **Construction Management** **3 (2+1)**

The objective of this course is to understand the basic concepts of management and to learn about local construction industry. These topics teaches the students to understand construction firms and their way of doing business. This course help understand concepts of project and project management. This course is specifically designed. for students who will work in construction sector. They will understand project management and it's related. Concepts in accordance with international standards which will help them to manage a construction project effectively. The course teaches the students project planning, scheduling and controlling by deterministic and probabilistic method Prepares students for a professional role in the management of construction projects by providing students with an understanding of both the people-related. and technical requirements necessary for the successful management of projects, as well as their organizational and strategic aspects. The course enables theoretical and conceptual exploration of construction project management issues whilst also stressing the essential practical aspects such as project control mechanisms, resource management, budgeting and cost management, stakeholder management, contract management, IT applications and information management.

Contents

1. Introduction to Construction Industry, Challenges, Key Players
2. Construction Project as per local Construction Industry
3. Prequalification, tendering, bidding, site investigation, mobilization planning
4. Project, Project Management
5. Project Management Knowled.ge Areas and Process Groups as per PMBOK
6. Project Life Cycle, Project Network Analysis, Resource Requirements
7. Standard Terminologies for Project Management
8. WBS, OBS, Responsibility Assignment Matrix
9. Project Planning & Scheduling
10. ADM, PDM
11. Critical Path Method including S-Curve
12. Earned. Value Analysis as project control
13. PERT
14. Resource Leveling, Gantt Chart.

Recommended Texts

1. Mubarak S. (2015). *Construction Project Scheduling & Control*. (3rd ed.). Hoboken: John Wiley & Sons.

Suggested Readings

1. Spinner M. (1991). *Elements of Project Management*. (2nd ed.). UK: Prentice Hall
2. Babcock D. L. (2013). *Managing Engineering and Technology*. (6th ed.). UK: *.Prentice Hall*

CE-327 Construction Management LAB 3 (2+1)

The objective of this course is to introduce the students with Oracle Primavera P6 as planning as scheduling software. P6 is a complete Enterprise Project Portfolio Management application with a powerful but easy-to-use interface. It completely tracks projects, portfolios, and resources across their full lifecycles capturing all related. costs, issues, risks, and performance metrics along the way. It also supports project templates, allowing you to reuse projects in full or in part. It is designed. for organizations that need. to manage multiple projects simultaneously and support multi-user access across job sites and throughout the entire organization. The lab course introduces the students with software's user interface and wide range of data views and features that enable them to manage their projects from initial concept review and approval through to completion in professional life. The course enables theoretical and conceptual exploration of construction project management issues whilst also stressing the essential practical aspects such as project control mechanisms, resource management, budgeting and cost management, stakeholder management, contract management, IT applications and information management.

Contents

19. Introduction of Oracle Primavera P6 software
20. Software Installation
21. Creating EPS and Project
22. Opening a project
23. Create WBS and entering Activities
24. Setting Calendar, customizing columns
25. Create OBS and setting Roles
26. Creating Resource Pool
27. Assigning Resources to Activities
28. Resource Leveling
29. S-Curve
30. Creating Gantt Chart.
31. Monitoring & updating baseline

Recommended Texts

1. Mubarak, S. (2015). *Construction Project Sched.uling & Control.* (3rd ed.). Hoboken: John Wiley & Sons.
2. *Oracle Primavera P6 User Guide,* Release 8.3

Suggested Readings

1. Spinner, M. (1991). *Elements of Project Management.* (2nd ed.). UK: Prentice Hall
2. Babcock, D. L. (2013). *Managing Engineering and Technology.* (6th ed.). UK: .*Prentice Hall*

CE-328 **Engineering Hydrology** **3 (2+1)**

The objective of this course is to introduce hydrology as both a science and as an engineering practice, particularly as relates to its application in water resources management and estimation. Students will have the opportunity to develop their theoretical knowled.ge on key aspects of hydrology, along with a more applied. appreciation of monitoring and modeling hydrological processes. Topics that will be developed. include understanding the Earth's water cycles, describing and monitoring components of the hydrological cycle, and modeling aspects of hydrological systems. The course will develop knowled.ge on topics ranging from climatology, atmospheric circulation and meteorological measurements, as well as more detailed. investigations into precipitation, stream flow measurement, hydrograph analysis, storm runoff, concepts in flood estimation and routing and groundwater flow. In addition this course will enable students to learn broad areas of hydrological engineering and principles of water management particularly in irrigated. agriculture.

Contents

1. Introduction: Hydrology, Hydrologic cycle and the water balance equation Practical uses of hydrology, Importance of hydrology.
2. Water Resources: Planning and development of water resources projects, Domestic, Industrial, Agricultural and other water usages, Water resources in Pakistan.
3. Water Management: Water management practices at basin level, canal level and farm level
4. Meteorology: The atmosphere and its composition, dew point and its measurement devices, Saturation deficit,
5. Precipitation: Forms and types of precipitation, Factors necessary for the formation of precipitation, Measurement of precipitation, Interpretation of precipitation data, Computation of average rainfall over a basin.
6. Evaporation and Transpiration: Factors affecting evaporation, Measurement of evaporation, Evapo-transpiration.
7. Stream Flow:
8. Runoff & Hydrographs: Factors affecting runoff, Estimating the volume of storm runoff, Characteristics of Hydrograph, Components of a hydrograph, Hydrograph separation, Estimating the volume of direct runoff, Introduction to unit hydrograph concept, S-curve, Application of probability in determining maxima/minima of discharge.
9. Floods and their estimates: Introduction to floods and its causes, Methods to estimate floods, Return period and its estimation, Flood Frequency analysis
10. Stream Flow Routing: Reservoir routing, Channel routing, Flood Control, Introduction to Hydrological Modeling
11. Groundwater: Introduction, Sources and discharge of ground water,
12. Computer Application: Development of design worksheets and use of software (if any).

Recommended Texts

1. Warren Viessman, Jr. and Gary L. Lewis (2002). *Introduction to Hydrology*. (5th ed.) UK: Prentice Hall
2. R. K. Linsley, Max A. Kohler, and Joseph L. Paulhus. (1982). *Hydrology for Engineers* International, NY: McGraw-Hill ed.ucation

Suggested Readings

1. Linsley, R. K., J. Franzini. (1991). *Water Resources Engineering*. (4th ed.) NY: McGraw Hill;
2. Awan, N.M. (1981). *Surface Water Hydrology*. National Book Foundation

CE-329 **Engineering Hydrology LAB** **3 (2+1)**

An understanding of hydrology opens the door to a variety of interesting engineering problems that are especially relevant in today's world. The main aim of studying this subject is to understand the response to a watershed. to various meteorological events such as large storms, hurricanes and snow melt. A civil engineer with skill in hydrology can analyze these events to predict flood levels, design reservoirs and dams, size culverts and drains, and generally develop an engineering plan to manage water that results from storm events. There are numerous disciplines within the field of hydrology including drainage engineering, flood analysis, river mechanics, groundwater engineering and a number of other specialties. The field of hydrology also compliments disciplines such as geology, soil mechanics, water resources, land-use planning, agricultural engineering and several other fields. This course aims at familiarizing the students to learn broad areas of hydrological engineering and principles of water Management in hydrology lab.

Contents

1. To plot saturation curve and to find the saturation deficit, relative humidity and dew point temperature.
2. To examine the consistency of precipitation data record at a station and to adjust it.
3. To estimate the average rainfall over the basin area by using various methods.
4. To extend the rating curve by two methods.
5. To derive the ordinates of a unit hydrograph for the catchment.
6. To covert duration of a unit hydrograph from one to another.
7. To explore rainfall-runoff relationships using basic hydrology system
8. To asses hydraulic parameters for a confined. aquifer using Theis method.

Recommended Texts

1. ASTM, *ASTM Standards*. Philadelphia: American Society for Testing Materials
2. Warren Viessman, Jr. and Gary L. Lewis (2002). *Introduction to Hydrology*. (5th ed.) UK: Prentice Hall
3. R. K. Linsley, Max A. Kohler, and Joseph L. Paulhus. (1982). *Hydrology for Engineers* International, NY: McGraw-Hill ed.ucation

Suggested Readings

1. Abdul Razzaq Ghumman. (2004). *Engineering Hydrology an Introduction*. Prosperous Pakistan Publishers, Lahore.

CE-330 **Architecture and Town Planning** **3 (3+0)**

The main aim of this course is to understand ancient and modern form of living. Cities, buildings, parks and landscapes define the setting of our everyday life Some are fascinating works of art, and no other man made artefacts document the evolution of social relations, economic trends, technological innovations, philosophical views on man and nature, politics and culture more eloquently than architecture and urbanism. The course impart knowled.ge related. to planning and development of inhabitant areas. Explain town planning, evolution of the ancient towns and civilizations, factors governing from architecture of a given place and finishing materials in buildings. Moreover discover urban and regional places as meaningful entities, factors governing the architecture of a given place, interaction and relationship between population groups and economic activities, and the natural and built environments. Explain and implement preliminary studies, materials and different planning phases. Interpret and justify material selection and various processes for master planning.

Contents

1. Architecture: Historical Development, General introduction to history of architecture, Emergence/Development of Islamic Architecture, Geographical, climatic, religious, social and historical influences, Architectural beauty
2. Qualities, Factors and Use of Materials: Strength, vitality, grace, breadth and scale, Proportion, colour and balance, Stone, wood, metals, concrete, composites, ceramics
3. Architectural Aspects of Building Planning: Walls and their construction, Openings and their position, character and shape, Roofs and their development and employment, Columns and their position, form and decoration, Moulding and their form decoration, Ornament as applied. to any buildings
4. Town Planning: Definitions, Trends in Urban growth, Objectives of town planning, Modern planning in Pakistan and abroad
5. Preliminary Studies: Study of natural resources, economic resources, legal and administrative problems, Civic surveys, Preparation of relevant maps
6. Land Use Patterns, Street Patterns: Various theories of land use pattern, Location of Parks and recreation facilities, Public and semi-public buildings, Civic centers, commercial centers, local shopping centers, Public schools, industry & residential areas, Layout of street, road crossing & lighting, Community planning
7. City Extensions and Urban Planning: Sub Urban development, Neighborhood Units, Satellite Towns and Garden City, Issues related. to inner city urban design and emergence/up gradation of squatter settlements

Recommended Texts

1. Sir Rymond Unwin (2010), *Town Planning in Practice.* FQ: Legacy Books.

Suggested Readings

1. Dan Cruickshank, Sir Banister Fletcher's (1996). *A History of Architecture.* (20th ed.)Architectural Press;.
2. Leonard Benevolo; (1971). *Origins of Modern Town Planning,* USA: MIT Press.

CE-411 **Environmental Engineering-II** **2 (2+0)**

Pre-requisite for this course is Environmental Engineering-I. The main aim of this course is study of environmental engineering. This course introduces the basic concept of environmental issues, environmental legislation and regulations at national and international levels. Environmental Impact Assessment study helps to identify the social, cultural, and health impacts of any project on the environment. In this syllabus, the main focus to analyzed. physicochemical and microbiological characterization of sewage water. There is lot of hue and cry for control of the water pollution in the urban and rural areas through improving the entire sewage system, wastewater treatment technologies, sludge handling, disposal, and re-use of effluents and advance solid waste management techniques. The well-organized. building drainage system is also improving wastewater management. This study also introduces software applications to solve environmental issues. This course is aimed. at contemporary issues, challenges, trends, research and advancements in the field of environmental engineering with the vision of developing professionals to manage critical environmental problems Pakistan is currently facing.

Contents

1. Introduction to Environmental Legislation and Regulations:
2. Introduction to Environmental Impact Assessment:
3. Estimation of Sewage Quantities: Population characteristics, Population forecasting, Waste water generation, Rainfall intensity formulas, hydrograph & weather flow, sewage quantities, Variations and rates of flows, Velocity gradient & limiting velocities
4. Characteristics of Sewage: Sampling techniques and examination of wastewater (Physical, chemical and microbiological parameters) Biochemical Oxygen demand (BOD), Chemical Oxygen Demand (COD), Microbiology of sewage, Effluent disposal guideline and standards, Pakistan National Environmental Quality
5. Sewer System: Sewer system (Types, shapes, size and materials of sewers, pipe strengths and tests), Design, construction, laying and maintenance of sewer system, Separate & Combined. systems, Sewer appurtenances
6. Sewage Treatment and Disposal: Primary, secondary & tertiary treatment: Screening grit chamber, skimming tanks & sed.imentation tanks, Activated. sludge treatment, tricking filters, Rotating biological contactors, Aerobic systems, lagoons and oxidation ponds, etc.
7. Sewage Disposal: Receiving body assimilation capacity, Stream pollution and self-recovery, sludge handling, treatment & disposal, Effluent re-use
8. Building drainage: Soil pipes, anti-syphon pipes and waste water pipes, Sanitary fixtures and traps, House connection and testing of house drainage, Cross connection and back syphon age control
9. Solid waste management: Types, characteristics, Collection, disposal and recycling

Recommended Texts

1. Corbitt, R.A. (1999). *Standard Handbook of Environmental Engineering* (2nd ed.). New York: McGraw-Hill Handbooks.
2. Petts, J. and ed.uljee, G. (1994). *Environmental Impact Assessment for Waste Treatment and Disposal Facilities*. United. Kingdom: John Willey & Sons Inc.

Suggested Readings

1. Kiely, G. (1997). *Environmental Engineering* (International ed.). New York: McGraw-Hill.
2. Tchobanoglous, G. (1993). *Integrated. Solid WasteManagement* (Latest ed.). New York: McGraw-Hill.
3. Wood, C. (1995). *Environmental Impact Assessment: A Comparative Review*. United. Kingdom: Longman Scientific and Technical. Longman House Burnt Hill, Harlow Essex.

CE-412 Geotechnical and Foundation Engineering 4 (3+1)

The main aim of this course is to enhance the understanding of students regarding soil behaviour and help them to apply it to solve geotechnical engineering problems including foundation design. The course is a continuation of the second year soil mechanics course and extends the students' understanding of the mechanics of soils to include earth pressure, bearing capacity & soil improvement. Broadly Geotechnical Engineering encompasses acquisition, interpretation, and use of knowled.ge of earth's materials for the solution of engineering problems. The course will help students learn the methods of acquiring the knowled.ge and its use in engineering solutions. It also aims to acquaint students with the activities involved. in providing the appropriate foundation for a stable structure. This course is paramount for civil engineering students to ensure their proper understanding of geotechnical engineering and to prepare them for interaction with other disciplines in civil engineering that interface with it such as structural, transportation and hydraulics.

Contents

1. Earth pressures ; definition, pressure at rest, active and passive earth pressures
2. Coulomb's and Rankine's theories; Bell's equation for cohesive frictional soils
3. Earth pressure diagrams for different loading configurations
4. Bearing capacity of soils; gross, net, effective, ultimate & allowable (definitions)
5. Selection of bearing capacity type against particular loading; practical problems and solutions
6. Presumptive values from codes, from plate load test
7. Bearing capacity theories; bearing capacity from SPT and CPT data
8. Geotechnical investigation report; table of content
9. Site introduction and site specific requirement for geotechnical investigations
10. Geotechnical information to be included. in report and how
11. Slope stability and methods of analysis; types of slopes
12. Factors affecting stability & remedies, types of failure
13. Ordinary methods of slices; Taylor's stability number method; Swedish circle method
14. Earth and rock fill dams; definition of an earth dam, types of earth and rock fill dams
15. Components of earth dam, their functions, general design considerations & typical cross-sections
16. Introduction to deep foundations; types of piles, load carrying capacity of piles
17. Group action, negative skin friction, pile load test
18. Soil improvement; basic principles, objectives and methods
19. Soil dynamics; sources of dynamic loading, spring-mass-dashpot system
20. Application to machine foundations, liquefaction

Recommended Texts

1. Bowles, J. E. (2001). *Foundation Analysis and Design*. NY: McGraw Hill.
2. Coduto, D. P. Yeung, M. R. & Kitch, W. A. (2001) *Geotechnical Engineering: Principles & Practices* (2nd ed.). NY: Pearson

Suggested Readings

1. Tomlinson, M. J. & Boorman, R. (1995). *Foundation Design and Construction* (6th ed.). China: Addison-Wesley Longman.
2. Das, B. M. (2018). *Principles of Foundation Engineering* (9th ed.). Boston: Cengage Learning.

CE-413 Geotechnical and Foundation Engineering LAB 4 (3+1)

The main aim of this lab is to cover all such experiments that are related. to advanced. soil experimentation. Knowing the behavior of soil mass under different loading conditions is an essential requirement for any kind of civil works. For this purpose, this lab contains all such experiments that are performed. in field to assess the real time situation of soil mass under loading conditions. Simulation based. Experiments are also performed. in this lab to simulate the loading condition of field in lab. At the end of this lab students will be able to perform both lab and in situ tests that are required. to estimate the shear strength, bearing capacity, densities, and settlement characteristics of any soil mass. Apart from testing, students will also be able to read and prepare soil reports of different sites and asses their soil conditions particularly. This lab will have direct impact on their field knowled.ge in terms of field related. tests.

Contents

1. Direct shear test
2. Unconfined. compression test
3. Triaxial compression test
4. Standard proctor test SPT
5. Plate load test
6. Consolidation test
7. Electrical Resistivity
8. California Bearing ratio test
9. Clegg hammer impact test

Recommended Texts

1. J. E. Bowles, (1996). *Foundation Analysis and Design*, (5th ed.). NY: McGraw Hill.

Suggested Readings

1. Yang H. Huang, (1992). *Pavement Analysis & Design.* NY: Pearson
2. Ralph B. Peck, W.E. Hanson. (1974). *Foundation Engineering*, Hoboken: John Willey & Sons,

CE-414 Transportation Engineering-II 4 (3+1)

The main aim of this course is to equip students with knowled.ge related. to highway design, construction, and maintenance and traffic operations. Transport engineering is the application of technology and scientific principles to the planning, functional design, operation and management of facilities for any mode of transportation in order to provide for the safe, efficient, rapid, comfortable, convenient, economical, and environmentally compatible movement of people and goods transport. Transportation engineering, primarily involves planning, design, construction, maintenance, and operation of transportation facilities. Learn the basic concepts of traffic engineering. Apply the basics of traffic engineering for effective traffic management. Explore the Fundamentals of Traffic Flow, Traffic Studies, Concepts of Capacity and Level of Service, Travel Demand Forecasting for Highways. Learn the basic concepts of pavement analysis and design. Design the rigid and flexible pavements by using the principles of design, empirical and analytical design procedures. Investigate properties and quality of asphalt mix, embankment, Subgrade, Subbase and Base courses, Bituminous Surface courses, Internal and Surface Drainage of Pavements. Introduction to the pavement evaluation, maintenance and strengthening techniques/procedures.

Contents

1. Introduction to Road Systems: Location Survey in Rural and Urban Areas, Urban Location Controls, Highway Planning
2. Highway Engineering: Highway Components, Elements of a typical cross-section of road, Types of cross-section
3. Classification of Highways: Highway Materials, Types & Characteristics, Specifications & Tests, Introduction to resilient behavior
4. Geometric Design : Design controls and criteria, Sight distance requirements, curves
5. Pavement Design: Types of pavements, Wheel loads, Equivalent single axle load, Repetition and impact factors, Load distribution characteristics, Design of flexible and rigid pavements, Highway drainage, Pavement failures, Introduction to non-destructive testing, Pavement evaluation, Construction, Maintenance and rehabilitation
6. Traffic Engineering: Operating and design speeds, Traffic flow parameters, their relationships and data collection methodologies, Traffic Survey, O & D Survey, Traffic Safety, At-grade and grade-separated. intersections, Traffic control devices, Capacity analysis, Traffic management, Level of service and signal timing for an intersection

Recommended Texts

1. Mannering, F. Walter K. & Scott W. (2007). *Principles of highway engineering and traffic analysis*. Hoboken: John Wiley & Sons.
2. Jason C. Yu, (1982). *Transportation Engineering Introduction to Planning, Design and Operations* Elsevier Science Ltd.

Suggested. Readings

1. Salter R. J. (1996). *Highway Traffic Analysis and Design*. (3rd ed.). London: Palgrave Macmillan
2. Croney D. (2008). *The Design and Performance of Road Pavements,* 3rd ed. NY: McGraw-Hill Professional.

CE-415 Transportation Engineering-II LAB 4 (3+1)

This lab aims to cover all the tests that are related. to the road construction. Flexible pavement construction majorly involves two constituents' bitumen and aggregates. Suitability of these constituents for road construction is judged. by testing them under different conditions e.g. loading, climate and traffic effects. Tests involved. in transportation engineering lab include all important tests for soil, aggregate and bitumen. Moreover, the combined. action of these products is analyzed. by preparing composite material in different tests. Students will have the opportunity to not only judge the suitability of material for road construction but also to assess their strength and properties when in-place. At the end of this lab, students will have extensive knowled.ge on engineering properties of pavement materials and their usage at right place. Physical performance of these tests will also enable them about the handling of these material in heated. and cold forms.

Contents

1. Aggregate Gradation Test
2. Impact Values of Aggregates
3. Los Angles Abrasion Test
4. Specific gravity & Absorption Test of Coarse Aggregates
5. Shape Test of Aggregates
6. Lab CBR Test
7. Penetration test of bitumen
8. Ductility test of bitumen
9. Softening point test of bitumen
10. Flash and fire point test of bitumen.
11. Viscosity test for bituminous materials
12. Marshall Stability and flow test

Recommended Texts

1. Croney D. (2008). *The Design and Performance of Road Pavements*. (3rd ed.). NY: McGraw-Hill Professional.
2. Fred. L. Mannering, Scott S. Washburn, Walter P. Kilareski (2008). .*Principles of Highway Engineering and Traffic Analysis.* (4th ed.) Hoboken: Wiley

Suggested Readings

1. Salter R. J. (1992). *Highway Traffic Analysis and Design.* (3rd ed.). London: Palgrave Macmillan.

CE-416 Hazard and Disaster Management 3 (3+0)

The main aim of this course is to acquaint students with the major disasters and their effective management. Disaster Management as a subject, essentially deals with management of resources and information as far as a disastrous event is concerned. and also how effectively and seamlessly the resources are coordinated. while at the individual &organizational level, it deals with issues of planning, coordinating, communication and risk management. This course will help students become an efficient part of disaster management by imparting a broad spectrum of knowled.ge regarding various types of disasters, their characteristics & effects, events that follow, phases of its management and the role of government in its prevention and control. Also, equally important, the familiarity with various international and national agencies involved. in disaster relief and humanitarian assistance as well as the frameworks developed. to ensure sustainability at every step i.e. preparedness, response and rehabilitation is also a part of course.

Contents

1. Introduction to hazards & disasters (earthquakes, floods, droughts, landslides, cyclones, etc.)
2. Social & economic aspects of natural and human induced. hazards
3. Hazard and disaster investigation
4. Disaster management, pre-disaster phase (prevention, mitigation & preparedness)
5. Disaster phase (response, relief and recovery)
6. Post-disaster phase (rehabilitation, development)
7. Damage assessment
8. Disaster management policies and institutional infrastructure from national to local level
9. Monitoring of infra-structure facilities; strategies for protection against possible damages
10. Maintenance for different infrastructure facilities. Rehabilitation and repair strategies
11. Pred.ictions and prepared.ness strategies for natural disasters such as earthquakes etc.
12. Emergency management; awareness programs; follow-on disasters; recovery plans
13. Strategies for protection, risk and vulnerability analysis; disaster mitigation

Recommended Texts

1. Schneid, T. D. & Collins, L. R. (2000). *Disaster Management and Prepared.ness* (1st ed.). CRC Press.
2. Alexander, D. (2002).*Principles of Emergency Planning and Management* (1st ed.). Oxford University Press.

Suggested Readings

1. Godschalk, D., Beatley, T., Berke, P., Brower, D. & Kaiser, E. J. (1998).*Natural Hazard Mitigation: Recasting Disaster Policy and Planning* (1st ed.). Island Press.
2. Benson, C.& Clay, E. J. (2004).*Understanding the Economic and Financial Impacts of Natural Disasters*. World Bank.
3. Asian Disaster Prepared.ness Centre. (2005).*The Primer on Disaster Risk management in Asia*. Clung Wicha Press.
4. Rego, A. J. (2003). *The Primer on Disaster Risk Management in Asia.* Asian Disaster Prepared. ness Centre.

CE-421 **Geo Informatics** **2 (1+1)**

This course will enable students to identify the theoretical and methodological foundations of Geo Informatics and GIS science including data models and data structures, spatial ontologies and linked. data, simulation and spatial-temporal modeling, remote sensing and spatial data capture, as well as spatial analysis and computational methods. Students will leave with hands-on analytical skills in different GIS and remote sensing software packages and open source geospatial software tools. Remote Sensing includes image processing methods, satellite technologies and use of images in different application areas. In addition this course will enable students to acquaint with state-of-the-art Geo-informatics and its diverse applications in engineering. At the end of this course students will be able to plan and conduct GIS project independently. This course provides the basic theoretical knowled.ge and hands-on experience required. to perceive the synergy within this multidisciplinary production environment. It will foster improved. mutual understanding, collaboration, and the effective exchange of geo-information between the different domains in the organization, leading to higher-quality output.

Contents

1. Introduction to Geo Informatics and Resources of information: Photogrammetric surveying
2. Satellite System, Aerial and Satellite photogrammetry, Google Earth.
3. Geographic Information System (GIS): Fundamentals of GIS, Spatial Data types and acquiring consideration, Data models and structures, Coordinate Systems, Datums and map projections and their transformation, Attribute-based. operation, Introduction to Spatial Analysis.
4. Remote Sensing (RS): Basic Concepts, Physicals basis of Remote Sensing, Earth Resources Satellites / Platforms, Sensors, Types of Resolutions, Geo-referencing, Image Processing Techniques and Classification, Global Positioning System (GPS), Navigational Satellites, Positioning Systems (GLONASS, GPS & Galileo), Fundamentals and Elements of GPS, System Operation & Characteristics, Errors and Atmospheric effects, Differential GPS (DGPS).
5. Field and Laboratory work with Software: Training on GPS instruments based. surveys, Integration GPS data in GIS, Exercises on Image processing software and recent GIS software, Demonstration on RS/GIS applications in engineering disciplines.

Recommended Texts

1. Michael Kenned. (2002). *The Global Positioning System and GIS: An introduction* (2nd ed.). New York: Taylor & Frances

Suggested Readings

1. Clarke, K. (2004) *Getting Started. with Geographic Information System,*(2nd ed.). New York :Prentices Hall
2. Thomas, M. Lillesand& Ralph W. Kiefer (2005).*Remote Sensing and Image Interpretation.* (5th ed.), John Wiley & Sons, Inc.

CE-422 **Geo Informatics LAB** **2 (1+1)**

Geo informatics is considered. as a science and technology to address the problems of geography and geosciences. The main aim of this lab is to get acquainted. with state of the art geo-informatics and its application in civil engineering works. This lab covers learning about geographical information system and remote sensing. This lab enables the students to use software for GIS/RS applications related. to civil engineering domain. Students will have the opportunity to analyze data, explore issues, solve problems and evaluate situations in a geographical and spatial context. They will also learn to explore mapped. data, relate GIS with remote sensing technologies, develop and create maps and images to communicate spatial data to others in a meaningful way. Usage of computer based. applications of GIS and image processing software will develop an extra skill in students apart from their acquaintance with concepts and understanding of geo informatics and geographical information systems.

Contents

1. To locate the features on the ground, measure lengths and areas of the objects using Google earth.
2. To covert coordinate system of a map using GIS software.
3. To covert projection of a map using GIS software.
4. To generate a point coverage showing the meteorological station map.
5. To find the coordinates of a point on ground using GPS.
6. To use Differential GPS to carry out the topographic survey of the area.
7. Image processing using any Remote Sensing Software.

Recommended Texts

1. Michael Kenned.y (2002).*The Global Positioning System and GIS: An introduction* (2nd ed.). Taylor & Frances, New York.

Suggested Readings

1. Clarke, K. (2004) *Getting Started. with Geographic Information System*,(2nd ed.). Prentices Hall, New York,
2. Thomas, M. Lillesand& Ralph W. Kiefer (2005).*Remote Sensing and Image Interpretation*. (5th ed.), John Wiley & Sons, Inc.

CE-423 **Steel Structure** **3 (3+0)**

This course contains development of understanding of the behavior and design of structural steel members and connections using LRFD (Load and resistance factor design) method along with the behavior and characteristics of structural steel system. The structural design of buildings, whether of structural or reinforced. concrete, requires the determination of the overall proportions and dimensions of the supporting framework and the selection of the cross sections of individual members. Before any analysis, however, a decision must be made on the primary building material to be used. it will usually be reinforced. concrete, Structural Steel or both. Ideally, alternative designs should be prepared. with each. The emphasis in this course will be on the design of individual structural steel members and their connections. The structural engineer must select and evaluate the overall system in order to produce an efficient and economical design but cannot do so without a thorough understanding of the design of the components (the "building blocks") of the structure. Thus, component design is the focus of this course.

Contents

1. Introduction
2. Fundamentals of Working Stress Method
3. LRFD Method of Design
4. Plastic design and limits on design
5. Analysis and design of tension members
6. Analysis and design of Compression Members
7. Analysis and design of beams
8. Beam-column and axial-flexure interaction
9. Plate girder proportioning and design.
10. Simple welded. and bolted. connections
11. Overview of moment and shear connections

Recommended Texts

1. William Segui, (2013) *Steel Design.* (5th ed.) Boston: Cengage Learning
2. Charles G. Salmon, John E. Johnson, Faris A. Malhas, (2008), *Steel Structures: Design and Behavior.* (5th ed.) NJ: Prentice Hall.

Suggested. Readngs:

1. Spiegel & L. Burner. (2002). *Applied. Structural Steel Design*, NJ: Prentice Hall.
2. Zahid Ahmed. Siddiqi. (2017). *Steel Structures*, (4th ed.) Lahore: Help Civil Engineering

CE-424 **Hydraulics &Irrigation Engineering** **4 (3+1)**

This course is divided. into two parts, hydraulics engineering and irrigation engineering. In hydraulics engineering advanced. concepts of fluid mechanics in relation to viscous flows are introduced. It covers laminar flows, transition to turbulence and turbulent flows and will be taught with civil engineering applications in mind. The students should understand the topics of steady and unsteady flow in open channel, Hydropower and sed.iment transport from the fundamental point of view. The students will also be able to analyze similitude & dimensional analysis and uniform flow in open channels. Irrigation engineering takes a special place in the field of water resources engineering as it has the potential to bring economic welfare and food security, but also has the potential to be harmful and destructive. Sound knowled.ge of the underlying principles and fundamentals is required. to ensure irrigation engineering is practiced. in a sustainable manner. Irrigation engineering provides that knowled.ge and teaches students to understand and criticize risks and benefits in this field. This course will enhance the capabilities of students related. to irrigation engineering, drainage system and canal network.

Contents

1. Steady Flow in Open Channel: Specific energy and critical depth, Dynamic equation of gradually varied. flow, surface profiles and back water curves, Humps and constrictions, Hydraulic jump, Broad crested. weirs, venturi flume and critical depth meters.
2. Unsteady Flow: Flow through pipes, orifices and over weirs under varying heads, Unsteady flow through pipe lines, water hammer, instantaneous and slow closure of valves, Surges in open channel
3. Dimensional Analysis and Similitude: Similitude in hydraulic models, similitude requirements, geometric, kinematics and dynamics similarities, dimensionless numbers and their significance, Releigh’s method, Buckingham’s PI-theorem and its application, physical models, techniques and analysis, Introduction to numerical models.
4. Dams and Hydro Power Engineering:
5. Canal Irrigation: Elementary concept about canal head works, selection of their site and layout, weirs and barrages, various components and functions, Canal Head Regulator, Measures adopted. to control silt entry into canals, silt ejectors and excluders, Design of weirs on permeable foundations, sheet piles and cut off walls, Design of irrigation channels (Lined./Unlined.) Kenned.y’s and Lacey’s
6. Hydraulic Structures: Canal Falls, flumes, canal outlets, Cross drainage works: types and functions.
7. Water logging and salinity
8. Drainage: Definition, Land reclamation, Surface Drainage, Subsurface Drainage,
9. Design using Software: Computer aided. design of irrigation channels.

Recommended Texts

1. Linsley, R. K., J. Franzini, *Water Resources Engineering*. (4th ed.) NY: McGraw-Hill
2. David, A. Chin, *Water Resources Engineering.* (2nd ed.) UK: Prentice Hall .

Suggested Readings

1. Linslay, R. K. and Joseph, B. F. (1992). *Water Resources Engineering*. NY: McGraw-Hill, Inc.
2. Robert, L. D. (1985). *Fluid Mechanics with Engineering Applications*. NY: McGraw-Hill, Inc
3. Hanif, C. (2008) *Open Channel Hydraulics*. (2nd ed.) NY: Springer

CE-425 Hydraulics & Irrigation Engineering LAB 4 (3+1)

Hydraulic & Irrigation works are essential for the development of countries. In hydraulics engineering advanced. concepts of fluid mechanics in relation to viscous flows are introduced. It covers different types of flows occurring in open channels such as laminar flows, transition to turbulence and turbulent flows, steady and unsteady flow related. to civil engineering applications. The subject of irrigation has assumed. a worldwide importance since it holds the key to provide food to teeming billions living in developed. and developing countries. Being one of the largest continuous irrigation system with storage reservoirs and thousands of miles of canals, this subject is of utmost importance. The main aim of this course is the study of principles of hydraulics & irrigation engineering, particularly related. to open channel flow, flow through pipes, dam, canals and river engineering. This course mainly focuses on designing, analysis and operation of hydraulics and irrigation structures and problems relate to these structures. The study of Hydraulics and irrigation schemes integrated. with modern techniques are the basics of this particular course. This lab course familiarize student to perform experiments related. to open channels flows, their characteristics and design of irrigation structures.

Contents

1. To perform experiment on flume to plot E~y diagram and q~y diagram for uniform flow
2. To produce a hydraulic jump in tilting flume.
3. To analyze water hammer phenomena through water hammer apparatus.
4. To measure discharge on Ordinary Depth Flume.
5. To measure discharge on Critical Depth Flume.
6. Layout and design of an irrigation scheme.
7. Design of a typical outlet.
8. Design of a barrage.

Recommended Texts

1. Linsley, R. K., J. Franzini, *Water Resources Engineering*. (4th ed.) NY: McGraw-Hill
2. David, A. Chin, *Water Resources Engineering*. (2nd ed.) UK: Prentice Hall .

Suggested Readings

1. Linslay, R. K. and Joseph, B. F. (1992). *Water Resources Engineering*. NY: McGraw-Hill, Inc.
2. Robert, L. D. (1985). *Fluid Mechanics with Engineering Applications*. NY: McGraw-Hill, Inc
3. Hanif, C. (2008) *Open Channel Hydraulics*. (2nd ed.) NY: Springer

SOC-426 Citizenship ed.ucation & Community Engagement 3 (1+2)

The overall objectives of this course are to teach students the importance and role of active citizenship in promoting a productive, harmonious and developed. Society /world ed.ucate students about the importance of concepts, skills and philosophy of community linkages in developing a sustainable society. Inculcate the importance of community involvement for ensuring improve tolerant and generative society/world. Provide an opportunity to the students to develop their relationship with community. The course emphasized. how to experience the social contact with the community, and how to mobilize community for the development of the school. The course includes wider issues including culture, gender, special need.s, equity and equality and collaborative working condition within the school and community. This course will provide an orientation for the process of socialization and social development. It also emphasize on social factors which may affect ed.ucation. This course has not only a theoretical perspective but some practical aspects as well, like community work, improving social interaction activities, and promotion of healthy environment.

Contents

1. Introduction to Citizenship ed.ucation and Community Engagement
2. Identity, Culture and Social Harmony
3. Multicultural society and inter-cultural dialogue
4. Active Citizen: Locally active, Globally Connected.
5. Human rights, constitutionalism and citizen's responsibilities
6. Social issues in Pakistan
7. Social Action Project

Recommended Texts

1. Bodley, John H. (1994). *Cultural Anthropology, California:* California: Mayfield Publishing Co.
2. Harris Marvin. (1985). *Culture, People, nature; An Introduction to General Anthropology*. London: Harper and Row

Suggested Readings

1. Kottak, Conard Phillip. (2002). *Anthropology: The Exploration of Human Diversity.* (9th ed.) Boston: McGraw Hill Higher Ed.ucation
2. Wilson, Richard A. (1996). *Human Rights, Culture and Context: Anthropological Perspective.* London: Pluto Press

COURSE OUTLINE BRIEFS

DEPARTMENT OF MECHANICAL ENGINEERING

SARGODHA UNIVERSITY
Pathway to Progress

FACULTY OF ENGINEERING AND TECHNOLOGY

OVERVIEW

Mechanical engineering is one of the most diverse engineering fields available, embracing many subfields and affecting all aspects of our lives.Mechanical engineers work on new machines, products and processes that hold the promise of better lives for all of us. They are concerned with both technological and economic aspects in the design, development and use of their products.

The Department of Mechanical Engineering was established in September 2013. Since then, it has been offering BSc and MSc as morning programs containing course work along with final year projects. The Department is providing vibrant environment for studies, having qualified faculty and strong links to industry, with a vision to provide a modern world-class technical education in the age of urbanization and upward social mobility. The applications of mechanical engineering are quite diverse, including spacecraft, automobiles, energy and propulsion systems, machinery, manufacturing and materials processing.

The program continues to expand with the acceleration of technological development and mechanical engineers are engaged more and more in activities involving interaction with other disciplines. Mechanical engineers have bulk opportunities of employment within the country that is fast urbanizing. This program is running keeping in view the guidelines provided by the HEC/PEC.

Mission:
The department aims to provide the students, fundamental mechanical engineering knowledge, skills and professional experience by imparting high quality education so that they may participate in industry and academics actively.

Mechanical Engineering Program Educational Objectives:
Following four program educational objectives (PEOs), form the basis of BSc Mechanical Engineering program.

PEO 1: Have strong competence in mechanical engineering resulting in successful careers.

PEO 2: Pursuing research and innovation and be able to provide technical solutions for engineering industry problems.

PEO 3: Leading or participating in efforts to address socio economic and technical challenges.

PEO 4: Enhancing their professional development and technical capability through continuing education.

BSc Mechanical Engineering

Eligibility: At least 60% marks in F.Sc. (Pre-Engineering) or equivalent
Merit Determination: 70% Weightage of F.Sc. marks and 30% weightage of UET Entry Test

Duration: 4 Years
Semesters: 8
Degree Requirements: Minimum 130 cred.it hours

Semester-1

Course Code	Course	Lec.Hrs	Lab. Hrs	SCH
MATH-111	Mathematics-1	3	0	3
Phy-112	Applied. Physics	2	0	2
CHEM-113	Applied. Chemistry	2	0	2
ENG-114	Functional English	2	0	2
CE-115	Computer Systems and Programming	2	0	2
CE-116	Computer Systems and Programming (Lab)	0	3	1
ME-117	Engineering Drawing and Graphics	2	0	2
ME-118	Engineering Drawing and Graphics (Lab)	0	3	1
ME-119	Introduction to Engineering	1	0	1

Semester-2

Course Code	Course	Lec.Hrs	Lab. Hrs	SCH
EE-121	Electrical Engineering	2	0	2
EE-122	Electrical Engineering (Lab)	0	3	1
MATH-123	Mathematics-2	3	0	3
ENG-124	Communication Skills	1	0	1
ENG-125	Communication Skills (Lab)	0	3	1
ME-126	Workshop Practice (Lab)	0	6	2
ME-127	Engineering Mechanics-I: Statics	3	0	3
ME-128	Engineering Mechanics-I: Statics (Lab)	0	3	1
ME-129	Engineering Materials	3	0	3

Semester-3

Course Code	Course	Lec.Hrs	Lab. Hrs	SCH
PK.ST-211	Pakistan Studies	2	0	2
ME-212	Engineering Mechanics-II: Dynamics	3	0	3
ME-213	Engineering Mechanics-II: Dynamics (Lab)	0	3	1
ME-214	Mechanics of Materials–I	3	0	3
ME-215	Thermodynamics-I	3	0	3
EE-216	Electronics Engineering	2	0	2
EE-217	Electronics Engineering (Lab)	0	3	1
MATH-218	Mathematics-3	3	0	3

Semester-4

Course Code	Course	Lec.Hrs	Lab. Hrs	SCH
MATH-221	Mathematics-4	2	0	2
MATH-222	Mathematics-4 (Lab)	0	3	1
ME-223	Thermodynamics-II	3	0	3
ME-224	Machine Design-I	3	0	3
ME-225	Machine Design-I (Lab)	0	3	1
ME-226	Mechanics of Materials-II	3	0	3
ME-227	Mechanics of Materials (Lab)	0	3	1
ME-228	Fluid Mechanics-I	3	0	3
ME-229	Thermodynamics Lab	0	3	1

Semester-5

Course Code	Course	Lec.Hrs	Lab. Hrs	SCH
ME-311	Fluid Mechanics-II	3	0	3
ENG-312	Technical Report Writing and Presentation Skills	1	0	1
ENG-313	Technical Report Writing and Presentation Skills (Lab)	0	3	1
ME-314	Machine Design-II	2	0	2
ME-315	Machine DesIign-II (Lab)	0	3	1
ISL-316	Islamic Studies	2	0	2

ME-317	Heat & Mass Transfer	3	0	3
ME-318	Manufacturing Processes	3	0	3
ME-319	Manufacturing Processes (Lab)	0	3	1
ME-320	Fluid Mechanics Lab	0	3	1

Semester-6

Course Code	Course	Lec.Hrs	Lab. Hrs	SCH
STAT-321	Engineering Statistics	3	0	3
ECOM-322	Engineering Economics	2	0	2
ME-323	Instrumentation and Measurement	2	0	2
ME-324	Instrumentation and Measurement (Lab)	0	3	1
ME-325	Mechanics of Machines	3	0	3
ME-326	Heating, Ventilating and Air Conditioning	3	0	3
ME-327	Heat Transfer and HVAC Lab	0	3	1
ME-328	Health , Safety and Environment	1	0	1
SOC-329	Social Sciences (Elective)	2	0	2

Semester-7

Course Code	Course	Lec.Hrs	Lab. Hrs	SCH
ME-411	Control Engineering	3	0	3
ME-412	Control Engineering (Lab)	0	3	1
ME-413	Mechanical Vibrations	3	0	3
ME-414	Internal Combustion Engines	3	0	3
ME-415	Technical Elective-I	2	0	2
ME-416	Senior Design Project-I	0	9	3
ME-417	Mechanisms and Mechanical Vibrations Lab	0	3	1

Semester-8

Course Code	Course	Lec.Hrs	Lab. Hrs	SCH
ME-421	Introduction to Finite Element Analysis	2	0	2
ME-422	Introduction to Finite Element Analysis (Lab)	0	3	1

ME-423	Technical Elective-II	2	0	2
MS-424	Management Elective	2	0	2
MS-425	Enterpreneurship	1	0	1
ME-426	Power Plants	3	0	3
ME-427	IC Engine & Power Plants (Lab)	0	3	1
ME-428	Senior Design Project-II	0	9	3

BSc
MECHANICAL ENGINEERING

MATH-111 **Mathematics-I** **3(3+0)**

This course includes the study of function of one variable, limits and continuity differentiation of function of one variable, properties of functions maxima and minima. This course covers indefinite integrals and techniques of integration. Upon successful completion of course the student will be able to understand the polar coordinates and polar curves, properties of famous plane curves and algebra of complex numbers and some applications of complex. Mathematics is essential in many fields, including natural science, engineering, med.icine, finance, and the social sciences. Applied. Mathematics has led. To entirely new mathematical disciplines, such as statistics and game theory. Mathematicians engage in pure mathematics (mathematics for its own sake) without having any application in mind, but practical applications for what began as pure mathematics are often discovered. later. Practical mathematics has been a human activity from as far back as written records exist. The research required. To solve mathematical problems can take years or even centuries of sustained. inquiry.

Contents

1. Functions of one variable, limits and continuity, differentiation of functions of one variable
2. Properties of differentiable functions, differentials and linear approximation
3. Maxima minima & curvature
4. Applied. optimization problems of functions of one variable
5. Indefinite integrals and techniques of integration,
6. Definite integrals and fundamental theorem of calculus
7. Applications of definite integrals
8. Polar coordinates and polar curves
9. Parametric functions and curves, conic sections and their parametric representations
10. Properties of famous plane curves
11. Algebra of complex numbers and some applications of complex numbers.

Recommended Texts

1. Thomas Jr., Weir M. D., Hass J. R., (2002) "*Thomas' Calculus*", (12th ed.), US: Addison Wisley
2. Stewart. J. (2008) "*Calculus: Early Transcendentals*". (6th ed.), US: Addison Wisley

Suggested Readings

1. Swokowski E., Olinick M., (1994) "*Calculus*" (6th ed.) US: Addison Wisley

Phy-112 **Applied. Physics** **2(2+0)**

Upon successful completion of the course, the student will be able to learn key concepts related. to position related. To kinetics including work, energy and momentum for particles. Apply the key concepts of electrostatic force/field/potential; electric dipole; electric flux and magnetic dipole, magnetic field etc. to real world / engineering problems. It is usually differs from engineering in that an applied. Physicist may not be designing something in particular, but rather is using physics or conducting physics research with the aim of developing new technologies or solving an engineering problem. This approach is similar to that of applied. mathematics. In other words, applied. physics is rooted. in the fundamental truths and basic concepts of the physical sciences but is concerned. with the utilization of these scientific principles in practical devices and systems. Applied. physicists can also be interested. in the use of physics for scientific research., velocity and acceleration in Cartesian coordinate system for particles and also understand the concepts

Contents

1. Measurement of Physical Quantities
2. Introduction to Mechanics: Rectilinear Motion, Vectors, Motion in two and three Dimension, Force and Motion.
3. Kinetic Energy and Work
4. Coulomb’s Law
5. Electric and Magnetic Fields
6. Gauss’s Law

Recommended Texts

1. Halliday R, and Walker, (2005). *Fundamentals of Physics* NJ: John Wiley & Sons
2. Houg D. Y, and Roger A. (2007), *Freed.man, University Physics* US: Addison-Weslay

Suggested Readings

1.Raymond A. Serway, John W. Jewett, Jr. (2004). *Physics for Scientists and Engineers with Modern Physis.* US: Cenage
2. Paul A. Tipler, Gene M. (2000). *Physics for Scientists and Engineers with Modern Physics* US: Cenage

CHEM-113 **Applied. Chemistry** **2(2+0)**

Upon successful completion of the course, the student will be able to demonstrate working knowled.ge of applied. chemistry and its application to mechanical engineering field. Identify chemical compounds with harmful effects on environment and propose their control. Apply the acquired. knowled.ge to identify, formulate and solve engineering problems of chemical nature in field of mechanical engineering. In the scope of its subject, chemistry occupies an intermed.iate position between physics and biology. It is sometimes called. the central science because it provides a foundation for understanding both basic and applied. scientific disciplines at a fundamental level For example, chemistry explains aspects of plant chemistry (botany), the formation of igneous rocks (geology), how atmospheric ozone is formed. and how environmental pollutants are degraded. (ecology), the properties of the soil on the moon (astrophysics), Chemistry addresses topics such as how atoms and molecules interact via chemical bonds to form new chemical compounds. There are four types of chemical bonds: covalent bonds, in which compounds share one or more electron(s); ionic bonds, in which a compound donates one or more electrons to another compound to produce ions

Contents

1. Physical Chemistry: Properties of various groups and periods of periodic table.
2. Atomic Structure and Interatomic bonding: Atomic structure, atomic bonding and mechanical bonding. Polymorphism and allotropic forms. Crystallography basics.
3. Basic Mechanical properties: Structure of metals and ceramics.
4. Thermo-chemistry: Chemical Thermodynamics, Hess's Law, heat of Formation and reaction, relation between H and U, measurement of heat reaction, Bomb calorimeter
5. Electrochemistry: Laws of electrolysis
6. Industrial Chemistry: Industrial chemistry introduction, manufacturing and uses of various hydrocarbons. Lubricants and oils. Production and application of paints, vulcanized. rubber and fuels. Environmental pollution and control.
7. Water Treatment Methods: Water softening, treatment of water for industrial purposes.

Recommended Texts

1. Brown W. H. and Brown L. S.,(2010). *Chemistry for Engineering Students* US: Cengage Learning.
2. Roussak O. V., Gesser H. D. (2008). *Applied. Chemistry: A Textbook for Engineers and Technologist* NY: Springer.

Suggested Readings

1. Zumdahl S. S. (2005), *Chemistry: An Atoms First Approach.* US: Cengage.
2. Tro N. J.(2002*), Chemistry: A Molecular Approach.* UK: UK: Pearson.
3. Shultz M. J.(2005), *Engineering Chemistry.* US: Cengage.
4. Bahl, B. S. Bahl, G. D. Tuli,(2010). *Essential of Physical Chemistry*. India: S. Chand Publishing.

ENG-114 **Functional English** **2(2+0)**

This course component has been designed. for the students of engineering keeping in view of the need.s of English language and its growing need.s in our society. In this course the students will be familiarized. with the usage of language in both written and spoken domain. The students will be introduced. to the usage of language composition and its functional need.s in this changing world scenario. Functional English is usage of the English language required. to perform a specific function. This is typically taught as a foundation subject when a good command of English is required. for academic study and career progression.[1] In some cases, a particular form of technical English, such as Aviation English, may be required. for a particular vocation. Such specialized. usage is known and taught as English for Specific Purposes (ESP). Functional linguistics is the approach to the study of language that sees functionality of language and its elements to be the key to understanding linguistic processes and structures.

Contents

1. Basics of Grammar
2. Parts of speech and use of articles
3. Sentence structure, active and passive voice
4. Practice in unified. sentence
5. Analysis of phrase, clause and sentence structure
6. Transitive and intransitive verbs
7. Punctuation and spelling
8. Comprehension
9. Answers to questions on a given text
10. Discussion
11. General topics and every-day conversation (topics for discussion to be at the discretion of the teacher keeping in view the level of students)
12. Listening
13. To be improved. by showing documentaries/films carefully selected. by subject teachers
14. Translation skills
15. Urdu to English
16. Paragraph writing
17. Topics to be chosen at the discretion of the teacher
18. Presentation skills , Introduction

Recommended Texts

1. Thomson A. J. and Martinet A. V.(2012). *Practical English Grammar Exercises 1.* (3rd ed.) UK: Oxford University Press
2. Thomson A. J. Martinet. A. V. (2008). *Practical English Grammar Exercises 2.* (2nd ed.) UK: Oxford University Press
3. Marie, C. Boutin, S. Francoise G, (1993). *Oxford Writing. Intermed.iate Supplementary Skills. Fourth Impression.* (3rd ed.) UK: Oxford University Press
4.

Suggested Readings

1. Brain T. Rod E. (1992). *Reading. Upper Intermed.iate Oxford Supplementary Skills. Third Impression.* UK: Oxford University Press

CE-115 Computer Systems & Programming 2 (2+0)

The aim of this course to understand the basic concept of computer terminology, Programming, and provides fundamental concepts for hardware & software. The students not only learn about relevant cutting-ed.ge technology trends, but they also gain better knowled.ge in general. A collection of computer programs, libraries, and related. data are referred. to as software. Computer programs may be categorized. along functional lines, such as application software and system software. The underlying method used. for some calculation or manipulation is known as an algorithm. This introductory course explains in straightforward terms the importance of learning about computers system and other computing devices, the various types of devices and their components, the principles by which computers work, the practical applications of computers and related. technologies, the ways in which the world is being changed. by these technologies, and the associated. risks and other potential association of computers and related. technologies. After completion, of course, the students are expected. to be reasonably good at basic concepts in computer system & basic programming, whereas C++ will be the language to implement these concepts.

Contents

1. Introduction to computer system: digital and analog computers, characteristics of computer, history of computer, generations of computer
2. Classification of computer, the computer system, the input-process-output concept, components of computer hardware, application of computers
3. The computer system hardware: central processing unit (CPU), memory unit, instruction format
4. Instruction set, instruction cycle, microprocessor, interconnecting the units of a computer, performance of a computer, inside a computer cabinet.
5. Computer memory: memory representation & hierarchy, registers, cache & primary memory.
6. Secondary memory, access types of storage devices, magnetic tape, magnetic disk, optical disk
7. I/O devices: input-output unit, input devices, human data entry devices, source data entry devices
8. Output devices, hard copy devices, soft copy devices, i/o port, working of i/o system.
9. Data representation: number system, conversion from decimal to binary, octal, hexadecimal
10. Operating system, objective, types &function of OS,
11. Introduction to Programming Languages their type and how to debug code (debugging).
12. Algorithm & Flow charts, Flowcharts of different problems
13. Introduction to C++ language, syntax, program structure and termination. variables and constants
14. Input/output functions in C++ language, Assignment operator & headers files
15. Introduction of Decision statements in C++ language. increment & Decrement operator.
16. Introduction of Loops in C++ language, Nested. Control Structures (Repetition, While, do/while, for, break and continue Statements), Switch Multiple-Selection Statement, and Logical Operators.
17. Introduction of arrays in C++ language programming and arrays input/output example

Recommended Texts

1. Deitel P. J., Deitel H., (2017), *C++ How to Program*, (10th ed.) UK: Pearson
2. Morley, D., & Parker, C. S. (2014). *Understanding computers: Today and tomorrow, comprehensive*.

Suggested Readings

1. Tucker, A. B., Bradley, W. J., Cupper, R. D., & Garnick, D. K. (1992). *Fundamentals of Computing*. NY: McGraw-Hill

ME-117 **Engineering Drawing & Graphics** **2(2+0)**

Upon successful completion of the course, the student will be able to learn the basic knowled.ge of drawing skill and also apply the concepts of basic drawing techniques to make a different views like plan view etc. The aim of this course is to demonstrate individually the drawings of plan, elevation and cross sections of machine parts, the process of producing engineering drawings is often referred. to as technical drawing or drafting Drawings typically contain multiple views of a component, although additional *scratch views* may be added. of *details* for further explanation. Only the information that is a *requirement* is typically specified. Key information such as *dimensions* is usually only specified. in one place on a drawing, avoiding red.undancy and the possibility of inconsistency. Suitable tolerances are given for critical dimensions to allow the component to be manufactured. and function. More detailed. Production drawings may be produced. Based. on the information given in an engineering drawing. Drawings have an information box or *title block* containing who drew the drawing, who approved. it, units of dimensions, meaning of views, the title of the drawing and the drawing number.

Contents

1. Orthographic Projection : Principle and Methods of projection, Orthographic projection, Planes of projection, First and Third-angle projection, Reference line
2. Projection of Points :A point is situated. in the first, second, third and fourth quadrant
3. Projection of Straight Lines :Line parallel and perpendicular to one or both the planes, Line contained. by one or both the planes, Projections of lines inclined. to both the planes, True length of a straight line and its inclinations, Methods of determining traces of a line
4. Projection of Planes (2D) :Types and Traces of planes, Projections of planes, Projections of oblique planes
5. Projections on Auxiliary Planes (2D) :Types of auxiliary planes and views, Projection of a point on an auxiliary plane, Projections of lines and planes
6. Projections of Solids (3D) :Types of solids and their projections, Projections of solids with axes inclined.
7. Section of Solids (3D) :Section of planes, prisms, pyramids, cylinders, cones, spheres, Methods of development, Triangulation development, Developments of lateral surfaces of right solids
8. Isometric Projections (3D) :Isometric axes, lines, planes, and scale, Isometric drawing or isometric view, Isometric drawing of planes or plane figures, prisms and pyramids, cylinders, cones and sphere

Recommended Texts

1. Bhatt N.D. (1995), *Engineering Drawing and Graphics*, India: Atlantic Publisher.
2. . Wiebe B, Mohler M. (1998). *Technical Graphics Communication*, NY: McGraw-Hill

Suggested Readings

1. Bertoline G. R., Wiebe, E. N. (2000). Technical Graphics Communication; NY: McGraw-Hill
2. Rogers D.F., Adams J.A. (1996).; Mathematical Elements for Computer Graphics, NY: McGraw-Hill

ME-119 **Introduction to Engineering** **1 (1+0)**

As a student engineer, you are part of the engineering profession. In this course, you will develop your identity as a modern engineer who will collaboratively contribute to sustainable and equitable communities. This course will broadly introduce the engineering profession and highlight the socio-technical and interdisciplinary nature of engineering. The themes of the course will enable students to: distinguish and practice professional conduct; communicate and interact in a style appropriate to academic and professional contexts, including oral, written, and graphical styles; explain the engineering method from problem formulation through the complete life cycle; generate and assess ideas and solution alternatives for engineering problem solving; critically evaluate proposed. engineering solutions in terms of sustainability, economic, environmental and social considerations; and apply basic project management strategies and processes. These themes will be explored. through a variety of team and project-based. learning activities. The course also exposes the students to issues related. to engineering practice such as working in teams, sched.uling, evaluating risk, and making ethical decisions.

Contents

1. Introduction to Engineering
a. Evolution of engineering, steam engine, electronics etc.
b. Effect of global wars for technology advancement
c. Existing materials/Evolution of emerging materials
2. Difference between Engineering, Science and Technology
3. The Disciplines of Engineering
4. Engineering Design
5. Interdisciplinary Engineering (Science, Technology and Society)
6. Global Engineering and the Future (Renewable energy)
7. Problem Solving Techniques in Engineering
8. Visualization and Graphics
9. Analytical Tools for Engineers
10. Professional Ethics and Engineering Management
11. Engineering Fundamentals (Statics, Dynamics, Thermodynamics, Circuitry, Economics)
12. Future Challenges for the betterment of society

Recommended Texts

1. Paul H. Wright (2018). *Introduction to Engineering*. (5^{th} ed.) NJ: Wiley & Sons
2. Saeed. Moaveni, (2017). Engineering Fundamentals*: An Introduction to Engineering,* SI ed. US: Cenage

Suggested Readings

1. David Blockley, (2014). *Engineering: A Very Short Introduction.*
2. Philip K, Robert B, William K, (2018). *Exploring Engineering: An Introduction to Engineering and Design. 4^{th} ed.* US: Academic Press.

ME-118 **Engineering Drawing & Graphics Lab** **1(0+1)**

Upon successful completion of the course, the student will be able to learn the basic knowled.ge of drawing skill and also apply the concepts of basic drawing techniques to make a different views like plan view etc. The aim of this course is to demonstrate individually the drawings of plan, elevation and cross sections of machine parts. The process of producing engineering drawings is often referred. to as technical drawing or drafting Drawings typically contain multiple views of a component, although additional scratch views may be added. of details for further explanation. Only the information that is a requirement is typically specified. Key information such as dimensions is usually only specified. in one place on a drawing, avoiding red.undancy and the possibility of inconsistency. Suitable tolerances are given for critical dimensions to allow the component to be manufactured. and function. More detailed. production drawings may be produced. based. on the information given in an engineering drawing. Drawings have an information box or title block containing who drew the drawing, who approved. it, units of dimensions, meaning of views, the title of the drawing and the drawing number.

Contents

1. Introduction to Engineering Drawing, I. S. specification for preparation of drawings, Use of drawing instruments and materials, Basic Tools, Lines: Types, configuration and application, Selection of line thickness
2. Lettering, Numbering and Dimensioning Vertical and inclined. single stroke letters, Lettering types and rules, Dimension lines, projection lines, leaders or pointer lines, Arrow heads, Dimensioning,
3. Geometric Construction Drawing simple geometric objects (polygon, pentagon and hexagons etc).
4. Orthographic Projections of different Solids I-beam etc.
5. Orthographic Projections of Machine Elements Rivets, Nut and bolts, Different kinds of threads, Lap and butt joints, Flange couplings, Journal bearing, Open bearing, Footstep bearing, Crankshaft, Bearings
6. Practical: Select a machine and study its operation and machine elements detail ,draw the 3D model of the machine and draw 2D drawings. Apply the real mechanism to the machine.

Recommended Texts

1. Bhatt N.D. (1995), *Engineering Drawing and Graphics*, India: Atlantic Publisher.
2. Wiebe B, Mohler M. (1998). *Technical Graphics Communication*, NY: McGraw-Hill

Suggested Readings

1. Bertoline G. R., Wiebe, E. N. (2000). *Technical Graphics Communication*; NY: McGraw-Hill
2. Rogers D.F., Adams J.A. (1996). *Mathematical Elements for Computer Graphics*, NY: McGraw-Hill

CE-116 **Computer Systems & Programming Lab** **1 (0+1)**

The aim of this course to understand the basic concept of computer terminology, Programming, and provides fundamental concepts for hardware & software. The students not only learn about relevant cutting-ed.ge technology trends, but they also gain better knowled.ge in general. A collection of computer programs, libraries, and related. data are referred. to as software. Computer programs may be categorized. along functional lines, such as application software and system software. The underlying method used. for some calculation or manipulation is known as an algorithm. This introductory course explains in straightforward terms the importance of learning about computers system and other computing devices, the various types of devices and their components, the principles by which computers work, the practical applications of computers and related. technologies, the ways in which the world is being changed. by these technologies, and the associated. risks and other potential association of computers and related. technologies. After completion, of course, the students are expected. to be reasonably good at basic concepts in computer system & basic programming, whereas C++ will be the language to implement these concepts.

Contents

1. Basics of Computer Software and Hardware: Computers & Applications, History of Computing, Introduction to Hardware and Software, Peripheral Devices, Data Representation, Number Systems, Conversion Methods, ASCII / Unicode, Microprocessors, Memory, Storage Devices.
2. Basic Computer Programming: Algorithms, Flowcharts & Pseudocode, Assignment Operators, If Selection Statement, If… Else Selection Statement, Nested. Control Structures, switch Multiple-Selection Statement, Passing Arrays to Functions, Searching Arrays, Pointers, Library Functions and Header Files

Recommended Texts

1. P. J. Deitel, H. Deitel,(2017) *C++ How to Program*. UK: Pearson
2. Morley, D., & Parker, C. S. (2014). *Understanding computers: Today and tomorrow, comprehensive*. US: Cenage

Suggested Readings

1. Tucker, A. B., Bradley, W. J., Cupper, R. D., & Garnick, D. K. (1992). *Fundamentals of Computing*. NY: McGraw-Hill

EE-121 **Electrical Engineering** **2 (2+0)**

Electrical Engineering is the first course of the two-course sequence in mechanical engineering related. to electrical and electronics stream. The course provides the undergraduate students with the foundation of basic laws, theory of linear electric circuits with passive elements and AC fundamentals. First portion of this course introduces concepts of charge, current and voltage to be followed. with the description of current and voltage sources. An introduction to networks and circuits is accompanied. by detailed. discussion of Ohm's law, Kirchhoff's laws, and delta-wye transformations. This is followed. by circuit analysis techniques using Nodal and Mesh Analysis, important theorems like source transformation, superposition, Theremin's, Norton's, and maximum power transfer theorem. Second portion of this course introduces operational amplifiers, capacitance, inductance, and their series & parallel combination. First order RL, RC Circuits and second order RLC circuits are also taught to find the transient and steady state response of these kind of circuits. Some Basic introduction of AC are also covered. in third potion of this course.

Contents

1. Basic concepts: units, voltage, current, power and energy, independent and dependent sources
2. Basic laws: introduction, ohm's law, nodes, branches, and loops, kirchhoff's laws, series resisters and voltage division, parallel resistors, and current divisions
3. Wye-delta transformations, delta to wye conversion, wye to delta conversion
4. Methods of analysis: introduction, nodal analysis, nodal analysis with voltage source
5. Mesh analysis, mesh analysis with current source
6. Circuits theorems: introduction, linearity property, superposition theorems
7. Source transformation, thevenin's theorems
8. Norton's theorem, maximum power transfer theorem
9. Operational amplifiers: ideal & non- ideal, inverter, voltage follower, summer,
10. Capacitors and inductors: capacitors, inductors, series & parallel capacitors and inductors
11. First order circuits: introduction, the source-free RC Circuit, the source-free RL circuit
12. Step response of an RC circuit, step response of an RL circuit
13. Second order circuit: introduction, the source-free series RLC circuit
14. The source-free parallel RLC circuit
15. AC fundamentals: sinusoids, phasors with circuit Elements, imped.ance, and admittance
16. AC power analysis: introduction, instantaneous and average power, effective or RMS Value
17. Three-phase circuits: introduction, balanced. three-phase voltages

Recommended Texts

1. Sadiku, M. N., & Alexander, C. K. (2007). *Fundamentals of electric circuits*. NY: McGraw-Hill.
2. Hayt, W. H., Kemmerly, J. E., & Durbin, S. M. (1986). *Engineering circuit analysis*. New York: McGraw-Hill.

Suggested Readings

1. Irwin, J. D., & Nelms, R. M. (2010). *Basic engineering circuit analysis* (Vol. 900). NJ: John Wiley & Sons.
2. Boylestad, R. L. (2013). *Introductory circuit analysis*. UK: Pearson ed.ucation.

EE-122 **Electrical Engineering Lab** **1(0+1)**

The main aim of this course is to understand the basic electrical engineering concepts. Students will able to learn DC circuits, Series and parallel circuits, DC circuit analysis. Theory of Alternating Current, Resistance, Inductance and Capacitance of AC circuits, Power Factor, Resonance in RLC circuits, Power and Power factor measurement, Current and Voltage relationship in phase and line circuits. Types, characteristics and testing of AC motors, Transformer, voltage current relationship of primary and secondary types of transformers, losses and efficiency, generators and motors types, construction and characteristics. An introduction to networks and circuits is accompanied. by detailed. discussion of Ohm's law, Kirchhoff's laws, and delta-wye transformations. This is followed. by circuit analysis techniques using Nodal and Mesh Analysis, important theorems like source transformation, superposition, Theremin's, Norton's, and maximum power transfer theorem. Second portion of this course introduces operational amplifiers, capacitance, inductance, and their series & parallel combination. Electrical Engineering is the first course of the two-course sequence in mechanical engineering related. to electrical and electronics stream. The course provides the undergraduate students with the foundation of basic laws, theory of linear electric circuits with passive elements and AC fundamentals.

Contents

1. To study the resistor colour code and its verification by using Ohm meter.
2. To study the relationship between voltage and current with the help of Ohm's Law.
3. To implement and verify voltage divider in series circuit and current divider in parallel circuit.
4. To study and verify Kirchhoff voltage law and Kirchhoff current law.
5. Analyze and Implementation of Thevenin's Theorem.
6. Experimental Verification of Maximum Power Transfer Theorem for a Network.
7. To Study and Implement RL Series Circuit.
8. To Study and Implement RC Series Circuit.
9. To Study and Implement RLC Series Circuit.
10. To implement and verify Power factor improvement by using static capacitors.
11. To perform No load test of the alternator to observe the change in its output parameters.
12. To perform short circuit test of the alternator to observe the change in its output parameters.
13. Perform Open Circuit Test to find out the core losses of a Single Phase Transformer.
14. Perform Short Circuit Test to find out the core losses of a Single Phase Transformer.

Recommended Texts

1. Sadiku, M. N., & Alexander, C. K. (2007). *Fundamentals of electric circuits*. NY: McGraw-Hill.
2. Hayt, W. H., Kemmerly, J. E., & Durbin, S. M. (1986). *Engineering circuit analysis*. New York: McGraw-Hill.

Suggested Readings

1. Irwin, J. D., & Nelms, R. M. (2010). *Basic engineering circuit analysis* (Vol. 900). NJ: John Wiley & Sons.Boylestad, R. L. (2013). *Introductory circuit analysis*. UK: Pearson ed.ition
2. Hayt, W. H., Kemmerly, J. E., & Durbin, S. M. (1986). *Engineering circuit analysis*. New York: McGraw-Hill.

MATH-123 **Mathematics-II** **3 (3+0)**

This course includes the study of first order differential equations, higher order linear differential equations, Laplace transforms, numerical methods, boundary value and initial value problems, qualitative analysis of solutions, and applications of differential in solving engineering problems. Ordinary differential equations (ODEs) arise in many contexts of mathematics and social and natural sciences. Mathematical descriptions of change use differentials and derivatives. Various differentials, derivatives, and functions become related. via equations, such that a differential equation is a result that describes dynamically changing phenomena, evolution, and variation. Often, quantities are defined. as the rate of change of other quantities (for example, derivatives of displacement with respect to time), or gradients of quantities, which is how they enter differential equations. Specific mathematical fields include geometry and analytical mechanics. Scientific fields include much of physics and astronomy (celestial mechanics), meteorology (weather modeling), chemistry (reaction rates) biology (infectious diseases, genetic variation), ecology and population modeling (population competition), economics (stock trends, interest rates and the market equilibrium price changes).

Contents

1. Differential equation; basic concepts and ideas; geometrical interpretation of first and second order differential equations (D.E)
2. **S**eparable equations, Red.ucible to Separable form
3. Exact D. E, integrated. factors. Linear first order differential equations
4. Bernoulli's differential equation. Families of curves, orthogonal trajectories, and applications of differential equations of first order to relevant engineering systems
5. Homogeneous linear differential equations of second order
6. Homogeneous equations with constant coefficients, the general solutions
7. Initial and boundary value problems, D- operator
8. complementary functions, and integrals. Real, complex and repeated. roots of characteristics equations
9. Cauchy equation, non-homogeneous linear equations. Applications of higher order linear differential equations
10. Ordinary and regular points and corresponding series solutions
11. Legendre equations and Legendre's polynomial
12. Bessel equations, Bessel Function of first kind
13. Gaussian Elimination Techniques
14. RREF, Rank of Matrix
15. Inverse of Matrix by Using G. E.
16. Application of Eigen Value and Eigen Vectors

Recommended Texts

1. Wylie C.R. (2000). Advanced. Engineering Mathematics (5^{th} ed.) NY: McGraw Hill ed.ition
2. Erwin K. (1996). Advanced. Engineering Mathematics (8th ed.) NJ: John Wiley & Sons

Suggested Readings

1. Arfken G. B., Weber H. J., Harris F. E. (2013). *Mathematical methods for physicists: a comprehensive guide*, (7th ed.) US: Academic Press
2. Riley, K. FM. Hobson, P. Bence S. J. (2006) *Mathematical Methods for Physics and Engineering: A Comprehensive Guide*, UK: Cambridge University Press.

ENG-124 **Communication Skills** **1(1+0)**

This course component has been designed. for the students of engineering keeping in view of the need.s of English language and its growing need.s in our society. In this course the students will be familiarized. with the usage of language in both written and spoken domain. The students will be introduced. to the usage of language composition and its functional need.s in this changing world scenario. Nonverbal communication describes the processes of conveying a type of information in a form of non-linguistic representations. Examples of nonverbal communication include haptic communication, chronemic communication, gestures, body language, facial expressions, eye contact etc. Nonverbal communication also relates to the intent of a message. Examples of intent are voluntary, intentional movements like shaking a hand or winking, as well as involuntary, such as sweating. Speech also contains nonverbal elements known as paralanguage, e.g. rhythm, intonation, tempo, and stress. It affects communication most at the subconscious level and establishes trust. Likewise, written texts include nonverbal elements such as handwriting style, the spatial arrangement of words and the use of emoticons to convey emotion.

Contents:

1. Essay Writing
2. CV and Job Application, Letter Writing , Memo
3. Translation Skills from Urdu to English
4. Study Skills
5. Skimming, Scanning, Intensive and Extensive reading, Speed. Reading
6. Précis Writing and Comprehension
7. Presentation Skills

Recommended Texts

1. Martinet. P, Thompson J. (2000) Practical *English Grammar* (4th ed.) UK: Oxford University Press.
2. Rai U. (2002). *English Language Communication Skills*. Himalaya Publishing House New Delhi.

Suggested Readings

1. Walker. K, Elaine. P. (2004). *New Grammar Practice*. London: Longman Publishers.
2. Swan. L, Michael.G. (2005). *Practical English Usage*. UK: Oxford University Press.
3. Kumar M.(2004). *An Introduction To Study Skills*, Famous Products Lahore.Jha, S K. *Communication Skills* (2010) Agimoon.com

ENG-125 **Communication Skills Lab** **1(0+1)**

This course component has been designed. for the students of engineering keeping in view of the need.s of English language and its growing need.s in our society. In this course the students will be familiarized. with the usage of language in both written and spoken domain. The students will be introduced. to the usage of language composition and its functional need.s in this changing world scenario. The students will be introduced. to the usage of language composition and its functional need.s in this changing world scenario. Nonverbal communication describes the processes of conveying a type of information in a form of non-linguistic representations. Examples of nonverbal communication include haptic communication, chronemic communication, gestures, body language, facial expressions, eye contact etc. Nonverbal communication also relates to the intent of a message. Examples of intent are voluntary, intentional movements like shaking a hand or winking, as well as involuntary, such as sweating. Speech also contains nonverbal elements known as paralanguage, e.g. rhythm, intonation, tempo, and stress

Contents:

1. Essay Writing
2. CV and Job Application, Letter Writing , Memo
3. Translation Skills from Urdu to English
4. Study Skills
5. Skimming, Scanning, Intensive and Extensive reading, Speed. Reading
6. Précis Writing and Comprehension
7. Presentation Skills

Recommended Texts

1. Martinet. P, Thompson J. (2000) Practical *English Grammar* (4th ed.) UK: Oxford University Press.
2. Rai U. (2002). *English Language Communication Skills*. Himalaya Publishing House New Delhi.

Suggested Readings

1. Walker. K, Elaine. P. (2004). *New Grammar Practice*. London:Longman Publishers.
2. Swan. L, Michael.G. (2005). *Practical English Usage*. UK: Oxford University Press.
3. Kumar M.(2004). *An Introduction To Study Skills*, Famous Products Lahore.Jha, S K. *Communication Skills* (2010) Agimoon.com

ME-126 **Workshop Practice Lab** **2 (0+2)**

The main aim of this course is to impart basic knowled.ge of the different engineering materials, tools, equipment and manufacturing processes, hands on experience with different equipment and machinery, hand tools-measuring, marking, holding, supporting and cutting tools etc. Detail study of basic processes in workshops namely machine shop, Carpentry shop, welding and electric shop. Machine shop is a room, building, or company where machining, a form of subtractive manufacturing, is done. In a machine shop, machinists use machine tools and cutting tools to make parts, usually of metal or plastic (but sometimes of other materials such as glass or wood). A machine shop can be a small business (such as a job shop) or a portion of a factory, whether a tool room or a production area for manufacturing. The parts produced. can be the end product of the factory, to be sold to customers in the machine industry, the car industry, the aircraft industry, or others. It may encompass the frequent machining of customized. components. In other cases, companies in those fields have their own machine shops.

Contents

1. Perform facing operation on cylindrical work piece using lathe machine.
2. Perform turning operation on cylindrical work piece using lathe machine.
3. Perform taper turning operation on cylindrical work piece using lathe machine.
4. Perform knurling operation on cylindrical work piece using lathe machine.
5. Perform parting off operation on cylindrical work piece using lathe machine.
6. Perform drilling operation on cylindrical work piece using lathe machine.
7. Perform Threading operation on cylindrical work piece using lathe machine.
8. Perform End Milling operation on a flat mild steel work piece.
9. Perform flat slot operation on cylindrical workpiece using Shaper machine.
10. Wiring of electrical board to control one lamp with one switch.
11. Wiring of electrical board to control one lamp with two way switches.
12. Wiring of electrical board to control stair lamp with two switches.
13. Wiring of three phase motor connection.
14. Installation of ceiling fan and to operate it with switch and regulator.
15. Complete wiring of tube light.
16. To file the given Mild steel piece into square shape.
17. Marking and drilling the filed. Mild Steel piece.
18. Internal threading of the filed. Mild steel Workpiece with the taps
19. Marking and cutting operations on the wood pieces.
20. Making different joints on the woodwork pieces.
21. Performing of different welding joints on given MS workpieces by arc weilding.
22. Performing of spot welding on the metal sheets.
23. Study of casting and molding processes.

Recommended Texts

1. Lab Manuals.
2. Rajender S (2004). *Introduction to basic manufacturing processes and workshop technology*, New Delhi: New Age International Pvt Ltd.
3. Chapman W. A. J. (1995). *Workshop technology*. India: CBS Publisher & Distributor.

Suggested Readings

1. Rajender S (2004). *Introduction to basic manufacturing processes and workshop technology*, New Delhi: New Age International Pvt Ltd.
2. Chapman W. A. J. (1995). *Workshop technology*. India: CBS Publisher & Distributor.

ME-127 **Engineering Mechanics-I: Statics** **3 (3+0)**

Upon successful completion of the course, the student will be able to understand concepts of vectors and scalars, forces, moments and couples. And apply the learned. concepts of forces, moments and couples to solve problems of equilibrium in 2-D and 3-D. Analyze structures such as plain trusses, frames and machines for reaction forces. Applied. mechanics, bridges the gap between physical theory and its application to technology. It is used. in many fields of engineering, especially mechanical engineering and civil engineering; in this context, it is commonly referred. to as engineering mechanics. Much of modern applied. or engineering mechanics is based. on Isaac Newton's laws of motion while the modern practice of their application can be traced. back to Stephen Timoshenko, who is said to be the father of modern engineering mechanics. Within the practical sciences, applied. mechanics is useful in formulating new ideas and theories, discovering and interpreting phenomena, and developing experimental and computational tools.

Contents

1. Introduction to subject
2. Force System, Introduction to Force System, Rectangular components, Moment, Couple and Resultants (Two-dimensional Force systems)
3. Equilibrium
4. Mechanical system isolation and Equilibrium condition in two dimensions
5. Equilibrium Conditions-Equilibrium in three Dimensions
6. Structures
7. Plane Trusses
8. Method of joints
9. Method of Sections and Space Trusses
10. Frames and Machines
11. Friction
12. Types of Friction

Recommended Texts

1. Meriam, J L Kraig L G, (2000), *Engineering Mechanics (Statics)*. NJ: John Wiley & Sons Inc.
2. Beer, F.P & Johnston, (2002). *Vector Mechanics for Engineers: Statics & Dynamics*. NY: McGraw Hill

Suggested Readings

1. Hibbeler RC, (2002). *Engineering Mechanics (Statics)*. NJ: Prentice Hall

ME-128 Engineering Mechanics-1 Statics Lab 1 (0+1)

This lab is primarily used. to provide and conduct engineering laboratory experiments on principles of statics. Presently, this lab is used. for undergraduate student to their laboratory experiment especially in statics field. Students will conduct various experiments related. to the topics what have they learned. before in lecture. They also will learn the proced.ures of measurement, software application and be familiar with the practical apparatus of statics. It is very important for a student to understand Engineering Mechanics in three modes. These three modes are Analytical, Graphical and Physical modes. This lab is for integrating the three modes. It is used. in many fields of engineering, especially mechanical engineering and civil engineering; in this context, it is commonly referred. to as engineering mechanics. Much of modern applied. or engineering mechanics is based. on Isaac Newton's laws of motion while the modern practice of their application can be traced. back to Stephen Timoshenko, who is said to be the father of modern engineering mechanics. Within the practical sciences, applied. mechanics is useful in formulating new ideas and theories, discovering and interpreting phenomena, and developing experimental and computational tools.

Contents

1. Verification of triangle law & parallelogram law of forces
2. Coefficient of friction of various pairs of surfaces & determination of angle of repose.
3. Determination of Centre of Gravity of Irregular object using the Plumb-line Method
4. Differential axle and wheel
5. Simple Screw Jack
6. Moment of inertia of flywheel
7. Study of forces in the members of jib crane.
8. To study simple machines.
9. Conservation of angular momentum
10. Simply Supported. Beam reactions.
11. Worm and Worm Wheel
12. Hooke’s law experiment.
13. The Relationship Between Linear and Angular Quantities
14. Verification of newton’s laws of motion
15. Verification of axial forces in the members of a truss

Recommended Texts

1. Hibbler R. C., (2002), Engineering Mechanics. UK: Pearson.
2. Meriam, J L Kraig L G, (2000), Engineering Mechanics. NJ: John Wiley & Sons Inc.
3. Beer, F.P & Johnston, (2002). Vector Mechanics for Engineers: Statics & Dynamics. NY: McGraw Hill

Suggested Readings

1 Walt Oler J. (2013). *Lecture Notes*. Texas Tech University.

ME-213 **Engineering Material** **3 (3+0)**

The main aim of this course is to understand the appropriate use and selection of various engineering materials in designing and manufacturing of components and associated. processes. To acquire knowled.ge related. to the microstructure of engineering materials. Materials science still incorporates elements of physics, chemistry, and engineering. As such, the field was long considered. by academic institutions as a sub-field of these related. fields. Beginning in the 1940s, materials science began to be more widely recognized. as a specific and distinct field of science and engineering, and major technical universities around the world created. ded.icated. schools for its study. Materials science is a syncretic discipline hybridizing metallurgy, ceramics, solid-state physics, and chemistry. It is the first example of a new academic discipline emerging by fusion rather than fission. Many of the most pressing scientific problems humans currently face are due to the limits of available materials and how they are used.? Thus, breakthroughs in materials science are likely to affect the future of technology significantly

Contents

1. Structure of Metals: Crystalline structure of metals, allotropy. Crystallographic planes, mechanisms in metals, slip and slip systems, dislocation, twinning, yield phenomenon and strain aging, Bauchinger effect.
2. Metals and Alloy Systems: Production of iron, wrought iron, cast iron. Production of steel and its classification, ferrite, austenite, S-iron, cementite, pearlite, martensite, bainite, etc. Iron-carbon phase diagram, alloying elements and their effect on the properties of alloy steel. Refining of copper, aluminum and zinc. Aluminum alloys, zinc alloys, copper alloys, brass and bronzes. Metals and alloys for special application. Corrosion of metals anti-corrosive coatings and paints.
3. Material Forms and Designation: Heat treatment critical temp, transformation on heating/cooling, annealing, normalizing, tempering, quenching, austempering, hardening, rolling processes and production of various steel sections such a billet, bar, rod, channel, Roll load calculation, British standards and ASTM standard specification on iron/steel.
4. Non Metals, Composition, properties and uses of plastics, rubber, ceramics, fiberglass, composite materials and polymers.
5. Polymers: Molecular structure, bonding & classification of polymer compounding, forming operations etc., plastics.
6. Ceramics and refractories: Ceramic bonding, properties, ceramics material, crystalline and amorphous, silica, glass etc., refractory materials and their types, Introduction to Composite Materials, Material failure analysis.

Recommended Texts

1. Degarmo E. P (2000) *Materials and Processes in Manufacturing.* NJ: Prentice Hall
2. Lindberg. (2004) *Process and Materials of Manufacturing.* UK: Taylor & Francis

Suggested Readings

1. Powell P. C. (2002), *Engineering with polymers*. NY: Springer.
2. William F. (2006), *Introduction to Engineering Materials*. NY: Smith McGraw-Hill Science.

PK.ST-211 **Pakistan Studies** **2 (2+0)**

Develop vision of historical perspective, government, politics, contemporary Pakistan, ideological background of Pakistan. Study the process of governance, national development, issues arising in the modern age and posing challenges to Pakistan. The subject is widely researched. in and outside the country, though outside Pakistan it is typically part of a broader South Asian studies or some other wider field. Several universities in Pakistan have departments and research centers ded.icated. to the subject, whereas many independent research institutes carry out multidisciplinary research on Pakistan Studies. There are also a number of international organizations that are engaged. in collaborative teaching, research, and exchange activities on the subject. In Pakistan, the subject is one of the three compulsory courses (along with the Urdu and English language courses) at the Secondary School and Higher Secondary school levels of ed.ucation.[12] It is also taught as a degree course at most of the Social Science departments in many universities. There are also university departments ded.icated. to the ed.ucation and research in Pakistan Studies

Contents

1. *Historical Perspective* , Ideological rationale with special reference to Sir Syed. Ahmed. Khan, Allama Muhammad Iqbal and Quaid-e-Azam Muhammad Ali Jinnah. Factors leading to Muslim separatism , People and Land, Indus Civilization, Muslim advent, Location and geo-physical features.
2. *Government and Politics in Pakistan Political and constitutional phases:* 1947-58 , 1958-71, 1971-77 , 1977-88 , 1988-99 , 1999 onward
3. *Contemporary Pakistan,* Economic institutions and issues , Society and social structure , Ethnicity, Foreign policy of Pakistan and challenges , Futuristic outlook of Pakistan

Recommended Texts

1. Burki, S.J. (1980). *State & Society in Pakistan,* NY: The MacMillan Press Ltd.
2. Akbar, S. Zaidi. (2000). *Issue in Pakistan's Economy.* Karachi: Oxford University Press,
3. S. M. Burke and Lawrence Ziring.(1993) Pakistan's Foreign policy: An Historical analysis. Karachi: Oxford University Press,

Suggested Readings

1. Wilcox, W. (1972). *The Emergence of Bangladesh.* Washington: American Enterprise, Institute of Public Policy Research,
2. Mehmood, S. (1994), *Pakistan Political Roots & Development.* Oxford: Oxford University Press.

ME-212 **Engineering Mechanics-II: Dynamics** **3 (3+0)**

Upon successful completion of the course, the student will be able to learn key concepts related. to kinematics and kinetics of particles in different Coordinate Systems. Solve problems related. to kinematics and kinetics of particles. Calculate various motion parameters related. to the kinematics of rigid bodies under translation and rotation / general plane motion. The study of dynamics falls under two categories: linear and rotational. Linear dynamics pertains to objects moving in a line and involves such quantities as force, mass/inertia, displacement (in units of distance), velocity (distance per unit time), acceleration (distance per unit of time squared.) and momentum (mass times unit of velocity). Rotational dynamics pertains to objects that are rotating or moving in a curved. path and involves such quantities as torque, moment of inertia/rotational inertia, angular displacement (in radians or less often, degrees), angular velocity (radians per unit time), angular acceleration (radians per unit of time squared.) and angular momentum (moment of inertia times unit of angular velocity).The dynamics of classical systems involving both mechanics and electromagnetism are described. by the combination of Newton's laws, Maxwell's equations, and the Lorentz force.

Contents

1. Introduction to subject and Basic Concepts
2. Kinematics of Particles
3. Rectilinear Motion
4. Plane Curvilinear Motion
5. Space Curvilinear Motion
6. Motion Relative to Trans Axes
7. Constrained. Motion of Connected. Particles
8. Kinetics of Particles
9. Second Law & Equation of Motion
10. Work and Energy
11. Linear Impulse and Momentum
12. Impact
13. Angular Momentum
14. Kinematics of Rigid Bodies
15. Plane Motion
16. Relative Velocity
17. Relative Acceleration
18. Kinetics of Rigid Bodies
19. Kinetics of Rigid Bodies

Recommended Texts

1. Meriam J.L, Kraig L G.(2004), *Engineering Mechanics (Dynamics)*. NJ: John Wiley & Sons Inc.
2. Beer & Johnston (1998). *Vector Mechanics for Engineers: Statics & Dynamics*. NY: McGraw-Hill

Suggested Readings

1. Hibbeler RC. (2000), *Engineering Mechanics (Dynamics)*, (13th ed.). NJ: Prentice Hall

ME-212 **Engineering Mechanics-II: Dynamics Lab** **1 (0+1)**

Upon successful completion of the course, the student will be able to learn key concepts related. to kinematics and kinetics of particles in different Coordinate Systems. Solve problems related. to kinematics and kinetics of particles. Calculate various motion parameters related. to the kinematics of rigid bodies under translation and rotation / general plane motion. The study of dynamics falls under two categories: linear and rotational. Linear dynamics pertains to objects moving in a line and involves such quantities as force, mass/inertia, displacement (in units of distance), velocity (distance per unit time), acceleration (distance per unit of time squared.) and momentum (mass times unit of velocity). Rotational dynamics pertains to objects that are rotating or moving in a curved. path and involves such quantities as torque, moment of inertia/rotational inertia, angular displacement (in radians or less often, degrees), angular velocity (radians per unit time), angular acceleration (radians per unit of time squared.) and angular momentum (moment of inertia times unit of angular velocity).The dynamics of classical systems involving both mechanics and electromagnetism are described. by the combination of Newton's laws, Maxwell's equations, and the Lorentz force.

Contents

1. To find the center of gravity of regular and irregular shapes.
2. Verification of Hook’s Law by measuring the elongation of spring caused. by load on the spring and finds the spring constant.
3. To find the moment of inertia of Fly Wheel about its axis of rotation.
4. To find resultant force by Force Table method.
5. To calculate the time period of simple pendulum and compare with theoretical values.
6. To investigate the equilibrium of moment of two arms liver.
7. Demonstrate the basic concept of conservation of angular momentum through real observation.
8. To find the velocity of rolling object with constant acceleration.
9. To calculate the time and frequency of connecting rods at different angles.
10. To calculate a deviation through gyroscope.
11. Find work done by the variable force under the graph of force and displacement.
12. To study Hook’s law of coupling at same angles.

Recommended Texts

1. Meriam J.L, Kraig L G.(2004), *Engineering Mechanics (Dynamics)*. NJ: John Wiley & Sons Inc.
2. Beer & Johnston (1998). *Vector Mechanics for Engineers: Statics & Dynamics*. NY: McGraw-Hill

Suggested Readings

1. Hibbeler RC. (2000), *Engineering Mechanics (Dynamics)*, (13th ed.). NJ: Prentice Hall

ME-214 **Mechanics of Materials-I** **3 (3+0)**

Upon successful completion of the course, the student will be able to understand the basics of mechanics of materials and their mechanical properties and also calculate the stresses and strains in mechanical structures and solve problems related. to bending, torsion and deflection in mechanical structures. Strength of materials, also called. mechanics of materials, deals with the behavior of solid objects subject to stresses and strains. The complete theory began with the consideration of the behavior of one and two dimensional members of structures, whose states of stress can be approximated. as two dimensional, and was then generalized. to three dimensions to develop a more complete theory of the elastic and plastic behavior of materials. An important founding pioneer in mechanics of materials was Stephen Timoshenko. The study of strength of materials often refers to various methods of calculating the stresses and strains in structural members, such as beams, columns, and shafts. The methods employed. to pred.ict the response of a structure under loading and its susceptibility to various failure modes takes into account the properties of the materials such as its yield strength, ultimate strength, Young's modulus, and Poisson's ratio;

Contents

1. Mechanical properties of materials; tensile, compressive and shear stress & strain
2. Moment of inertia
3. Axial loading, Hooke’s law, stress strain relationship
4. Thermal stresses
5. Torsion of circular bars,
6. Pure bending of beams, shear stresses in beams
7. Shearing force and bending moment
8. Beam deflection using various methods
9. Residual stresses and stress concentration in various engineering applications
10. Analysis of statically indeterminate problems,
11. Thin and thick curved. bars,
12. Thin walled. pressure vessels.

Recommended Texts

1. James M. G, Barry J. (2005), *Mechanics of Materials*. US: Cengage
2. Ferdinand P. Beer & Russel Johnston Jr (2000)., *Mechanics of Materials* NY: McGraw-Hill

Suggested Readings

1. Hibbeler R. C.,(2000) *Mechanics of Materials.* NJ: Prentice Hall
2. Benham. R P. Crawford P. J.,(2004) *Mechanics of Engineering Materials*. London: Longman

ME-215 **Thermodynamics-I** **3 (3+0)**

Upon successful completion of the course, the student will be able to understand the nature and role of the thermodynamics properties of matter and processes on appropriate diagrams. Apply and learn energy and entropy balances to the closed. and open systems. Analyze implications and limitations of the Second Law of Thermodynamics. Thermodynamics is a branch of physics that deals with heat, work, and temperature, and their relation to energy, radiation, and properties of matter. The behavior of these quantities is governed. by the four laws of thermodynamics which convey a quantitative description using measurable macroscopic physical quantities, but may be explained. in terms of microscopic constituents by statistical mechanics. Thermodynamics applies to a wide variety of topics in science and engineering, especially physical chemistry, chemical engineering and mechanical engineering, but also in fields as complex as meteorology. Irish physicist Lord Kelvin was the first to formulate a concise definition of thermodynamics in 1854[2] which stated., "Thermo-dynamics is the subject of the relation of heat to forces acting between contiguous parts of bodies, and the relation of heat to electrical agency

Contents

1. Introduction and Basic Concepts, First law of thermodynamics and its applications , System and boundary , Specific volume, pressure and temperature
2. Energy Analysis of closed. system, Energy balance of closed. system
3. Mass and Energy Analysis of Control Volumes , Energy analysis of power, refrigeration and heat pump cycles
4. The Second Law of Thermodynamics, Spontaneous and non-spontaneous processes , Thermodynamic cycles, irreversible and reversible process, and Carnot cycle , Clausius inequality.
5. Entropy , Entropy change, T-s diagram, entropy generation , Increase of entropy principle, entropy rate balance of closed. systems and control volumes , Isentropic efficiencies

Recommended Texts

1 Yunus A. C, Michael A.(2000), *Thermodynamics: An Engineering Approach*. NY: McGraw-Hill.

2. Moran M. J. and Shapiro H. O.(2002), *Fundamentals of Engineering Thermodynamics*. NJ: John Wiley & Sons

Suggested Readings

1. Sonntang, B., Van W.(2006) John, *Fundamentals of Thermodynamics*. NJ: Wiley & Sons

EE-216 **Electronics Engineering** **2 (2+0)**

This subject is intended. to provide students with the fundamentals of semiconductor physics and its application to common semiconductor devices. The course starts with an in-depth look at the theory of semiconductors including energy gap, mobility of electrons and holes, influence of temperature on conductivity, doping, photoconductivity, drift and diffusion of charge carriers and the ideal diode equation, diode models. Then, properties of the abrupt p-n junction are studied. and applied. to various practical devices including the signal diode, zener diode, varactor diode, photo-diode, light-emitting diode, bipolar junction transistor, and finally field effect transistors. Moreover application of diode as rectifier, clipper and clampers are studied. in it. BJTs and FETs along with its biasing, types and configurations are studied. in detail in the course. The course has a strong laboratory component. About half the experiments illustrate fundamental properties of semiconductor materials and half explore the characteristics and properties of a variety of semiconductor devices.

Contents

1. Semiconductor Devices, intrinsic and extrinsic materials, P-type and N-type materials
2. PN junction, diode, diode models, diode forward and reverse x-is tics, breakdown voltage.
3. Semiconductor Diodes: Photodiode, Schottky barrier diode, Zener diode
4. Diode application: Half wave rectifier, full wave center tapped. rectifier.
5. Diode applications: Full wave bridge rectifier, voltage doubler.
6. Diode applications: Clippers series, Clampers, parallel clippers
7. Basics of BJTs and working principle.
8. BJT characteristics and basic parameters
9. DC biasing of BJT using voltage divider circuit, Load line and Q point Concepts.
10. BJT as an amplifier and as switch.
11. BJT configurations: CE, CB, CC configurations.
12. Basic of FET construction and working principle.
13. FET types: JFET(N TYPE, P TYPE) , MOSFET(E-MOS, D-MOS), characteristics and parameters
14. DC biasing of FET(JFET (self-bias, voltage divider bias), MOSFET(drain feed.back bias, voltage divider bias)
15. FET configurations; CD,CG,CS configurations and their comparison

Recommended Texts

1. Thomas ,Floyd, (2012) “:Electronic Devices Conventional current version”, (9th ed.). NJ: Prentice Hall
2. Robert B and Louis N.,(2006) “Electronics Devices and circuits Theory,” (9th ed.). NJ: Prentice Hall

Suggested Readings

1. Theodore F. Bogart, JR. (1996) “Electronics devices and circuits”, (4th ed.). NJ: Prentice hall
2. Robert Paynter, (2006) “ Introductory Electronic devices and circuits: Electron Flow Version,” (7th ed.). NJ: Prentice Hall.

EE-216 Electronics Engineering Lab 1 (0+1)

This subject is intended. to provide students with the fundamentals of semiconductor physics and its application to common semiconductor devices. The course starts with an in-depth look at the theory of semiconductors including energy gap, mobility of electrons and holes, influence of temperature on conductivity, doping, photoconductivity, drift and diffusion of charge carriers and the ideal diode equation, diode models. Then, properties of the abrupt p-n junction are studied. and applied. to various practical devices including the signal diode, Zener diode, varactor diode, photodiode, light-emitting diode, bipolar junction transistor, and finally field effect transistors. Moreover, application of diode as rectifier, clipper and clampers are studied. in it. BJTs and FETs along with its biasing, types and configurations are studied. in detail in the course. The course has a strong laboratory component. About half the experiments illustrate fundamental properties of semiconductor materials and half explore the characteristics and properties of a variety of semiconductor devices.

Contents

1. Semiconductor Basics: Intrinsic & Extrinsic Materials, n-type & p-type Materials
2. Semiconductor Diode: Construction, Diode equivalent Circuits, Zener Diode, Diode Applications e.g. Clipper, Clampers, Rectifier (Half-Wave & Full-Wave).
3. Bipolar Junction Transistors (BJTs): Construction, Region of Operations, Different Configuration
4. Transistor Switching Networks along with DC Biasing. Field Effect Transistor (FET): Construction and Characteristics,
5. Different Configurations along with DC Biasing. BJT and FET Small Signal Equivalent Circuit: Modeling & Different Configurations

Recommended Texts

1. Thomas ,Floyd, (2012) ":Electronic Devices Conventional current version", (9th ed.) NJ: Prentice Hall
2. Robert Boylested. and Louis Nashelsky,(2006) "Electronics Devices and circuits Theory," (9th ed.), NJ: Prentice Hall,

Suggested Readings

1. Theodore F. Bogart, JR. (1996) "Electronics devices and circuits", (4th ed.), NJ: Prentice hall.
2. Robert Paynter, (2006) " Introductory Electronic devices and circuits: Electron Flow Version," (seventh ed.), NJ: Prentice Hall,

MATH-218 Mathematics-III 3 (3+0)

This course includes the study of first order differential equations, higher order linear differential equations, Laplace transforms, numerical methods, boundary value and initial value problems, qualitative analysis of solutions, and applications of differential in solving engineering problems. Mathematicians seek and use patterns to formulate new conjectures; they resolve the truth or falsity of such by mathematical proof. When mathematical structures are good models of real phenomena, mathematical reasoning can be used. to provide insight or pred.ictions about nature. Through the use of abstraction and logic, mathematics developed. from counting, calculation, measurement, and the systematic study of the shapes and motions of physical objects. Practical mathematics has been a human activity from as far back as written records exist. The research required. to solve mathematical problems can take years or even centuries of sustained. inquiry. Mathematics is essential in many fields, including natural science, engineering, med.icine, finance, and the social sciences. Applied. mathematics has led. to entirely new mathematical disciplines, such as statistics and game theory. Mathematicians engage in pure mathematics (mathematics for its own sake) without having any application in mind, but practical applications for what began as pure mathematics are often discovered. later

Contents

1. Matrix algebra and general properties of matrices
2. Elementary row operations, red.uction of matrices into echelon and red.uced. echelon form
3. Rank of a matrix, determinants and their properties
4. Solution of system of linear algebraic equations
5. Gaussian elimination and Gauss-Jordan method
6. Vector spaces, linear dependent and independent vectors, basis
7. Eigenvalue and eigenvectors
8. First and second differential equations and their solution techniques
9. Higher order linear differential equations
10. Applications of differential equations,
11. Power series solutions and systems of linear differential equations.

Recommended Texts

1. Dennis G, Zill, B. C. A, (2013), First Course in Differential Equations with Modeling Applications (10th ed.), USA
2. Erwin K. (2011), Advanced. Engineering Mathematics, (10th ed.), NJ: Wiley

Suggested Readings

1. Erwin K. (2011), Advanced. Engineering Mathematics, (10th ed.), NJ: Wiley.
2. Dennis G, Zill, B. C. A, (2013), First Course in Differential Equations with Modeling Applications (10th ed.), USA

ME-223 **Thermodynamics-II** **3(3+0)**

Thermodynamics, science of the relationship between heat, work, temperature, and energy. In broad terms, thermodynamics deals with the transfer of energy from one place to another and from one form to another. The key concept is that heat is a form of energy corresponding to a definite amount of mechanical work. The most important laws of thermodynamics are, the zeroth law of thermodynamics, the first law of thermodynamics, or the law of conservation of energy, the second law of thermodynamics, the third law of thermodynamics. Although thermodynamics developed. rapidly during the 19th century in response to the need. to optimize the performance of steam engines, the sweeping generality of the laws of thermodynamics makes them applicable to all physical and biological systems. In particular, the laws of thermodynamics give a complete description of all changes in the energy state of any system and its ability to perform useful work on its surroundings.

Contents

1. Review of Thermodynamics, Energetics, Efficiency
2. Exergy, Exergy balance, Exergetic efficiency
3. Gas Power Cycles, Air-Standard-Otto cycle, Diesel cycle, Dual and Brayton cycle, Regenerative gas turbines with reheat & inter cooling, Combined. cycles
4. Vapor and Combined. Power Cycles, Modeling and analyzing, Superheat and Reheat vapor power cycles, Regenerative vapor power cycles, Other vapor cycle aspects
5. Refrigeration Cycles, Vapor compression refrigeration systems, Cascade and Multistage systems, Absorption refrigeration, Heat pump, and Gas refrigeration systems
6. *Thermodynamic Property Relations and Gas Mixtures,* Mixture composition, P-v-T relations for gas mixtures, U, H, S and specific heats for gas mixtures.
7. *Chemical Reactions,* Combustion process and conservation of energy in reacting systems, Importance of mathematical relation
8. *Chemical and Phase Equilibrium,* Equilibrium fundamentals, Chemical potential and equilibrium.

Recommended Texts

1. Yunus A. Cengel and Michael A. Boles, (2010) Thermodynamics, An Engineering Approach. NY: McGraw-Hill.
2. T.D. Eastop and A. McConkey, (2004) Applied. Thermodynamics for Engineering Technologists. UK: Pearson.

Suggested Readings

1. Sonntang, B, and Van W, (212) *Fundamentals of Thermodynamics*. NJ: John Wiley & Sons.
2. Ibrahim D. and Marc A. Rosen (2006), *Exergy: Energy, Environment, and Sustainable Development*. NY: Springer.
3. Moran M. J. and Shapiro H. O. (2010), *Fundamentals of Engineering Thermodynamics*. NJ: John Wiley & Sons.

ME-224 **Machine Design-I** **3(3+0)**

Machine Design is the innovation of new and effective machines and improving the existing ones. A new or effective machine is one which is more economical in the overall cost of production and operation. The design is to formulate a plan for the satisfaction of a human need. In designing a machine component, it is necessary to have a good knowled.ge of many subjects such as Mathematics, Engineering Mechanics, Strength of Materials, Theory of Machines, Workshop Processes and Engineering Drawing. Machine design is an area of study in which one learns to design machine parts by utilizing its whole knowled.ge and experience in field of mechanical engineering. Consider a machine is produced. without carrying out the designing process. Then, there will be no data available regarding the machine and it may breakdown at any time without any prior indication. The reason for the failure cannot be identified. and also no repair work can be done on the machine. It is difficult to find the working load of a machine as the material used. in the machine components and the reaction forces acting between the machine components may not be known.

Contents

1. Introduction, Design philosophy, Types of design
2. Mechanical behaviour of materials, Concepts of stress and strain, Different types of stress and strain in a machine element, Stress-strain diagram, Actual and permissible stresses, Factor of safety
3. Design of keys and coupling, Basic concepts, Methodology
4. Design of Riveted. joint, Welded. joints, Bolted. joints, Basic concepts, Methodology
5. Design of Springs, Shafts, Basic concepts, Methodology
6. Metal fits and tolerances and Design Standards, Basic concepts of tolerance, Types of fits, ISO standard fits charts

Recommended Texts

1. Joseph E. Shigley,(2006) *Theory of Machines & Mechanisms.* NY: McGraw Hill.
2. Robert L. N. (2010) *Design of Machinery*. NY: McGraw Hill.

Suggested Readings

1. Robert L. Mott (2010),*Machine Elements in Mechanical Design.* NY: McGraw Hill.
2. Khurmi R. S. & Gupta J. K.,(2012) *A Textbook of Machine Design*. India: Eurasia **Publishing** House

ME-225 **Machine Design-I Lab** **1(0+1)**

The main aim of this lab is to study 3D modeling software i.e. Pro Engineer wildfire for 2D and 3D drawings. At the end of the lab students will be able to understand different techniques used. for drawing in 2D and 3D for this softwareMachine Design is the innovation of new and effective machines and improving the existing ones. A new or effective machine is one which is more economical in the overall cost of production and operation. The design is to formulate a plan for the satisfaction of a human need. In designing a machine component, it is necessary to have a good knowled.ge of many subjects such as Mathematics, Engineering Mechanics, Strength of Materials, Theory of Machines, Workshop Processes and Engineering Drawing. . Consider a machine is produced. without carrying out the designing process. Then, there will be no data available regarding the machine and it may breakdown at any time without any prior indication. The reason for the failure cannot be identified. and also no repair work can be done on the machine. It is difficult to find the working load of a machine as the material used. in the machine components and the reaction forces acting between the machine components may not be known.

Contents

1. To study 3D modeling software i.e. Pro Engineer wildfire for 2D and 3D drawings. At the end of the lab students will be able to understand different techniques used. for drawing in 2D and 3D for this software.
2. The lab majorly emphasis on the learning of primitives of software, solid modeling, surface modeling , wire frame modeling, 2D drawings, creating and assembling of mechanical parts. This software allows student to produce accurate drawings quickly and to save, revisit, ed.it, and print them and streamlining the workflow.

Recommended Texts

3. Joseph E. Shigley,(2006) *Theory of Machines & Mechanisms.* NY: McGraw Hill.
4. Robert L. N. (2010) *Design of Machinery*. NY: McGraw Hill.

Suggested Readings

3. Robert L. Mott (2010),*Machine Elements in Mechanical Design.* NY: McGraw Hill.
4. Khurmi R. S. & Gupta J. K.,(2012) *A Textbook of Machine Design*. India: Eurasia **Publishing** House

ME-226 **Mechanics of Materials–II** **3(3+0)**

Strength of materials, also called. mechanics of materials, deals with the behavior of solid objects subject to stresses and strains. The complete theory began with the consideration of the behavior of one- and two-dimensional members of structures, whose states of stress can be approximated. as two dimensional and was then generalized. to three dimensions to develop a more complete theory of the elastic and plastic behavior of materials. The study of strength of materials often refers to various methods of calculating the stresses and strains in structural members, such as beams, columns, and shafts. The methods employed. to pred.ict the response of a structure under loading and its susceptibility to various failure modes takes into account the properties of the materials such as its yield strength, ultimate strength, Young's modulus, and Poisson's ratio; in addition the mechanical element's macroscopic properties (geometric properties), such as its length, width, thickness, boundary constraints and abrupt changes in geometry such as holes are considered.

Contents

1. Analysis of stress and strain in two and three dimensions
2. Principal stresses and strains.
3. Mohr's circle for stress and strain
4. Thick walled. pressure vessels
5. Symmetrical and asymmetrical loading
6. Introduction to fracture mechanics
7. Impact loading
8. Fatigue and creep
9. Virtual work
10. Theories of elastic failure
11. Theory of columns

Recommended Texts

1. Hibbeler R. C. (2008), *Mechanics of Materials.* NJ: Prentice Hall
2. Ferdinand P. B. & Russel J. Jr (2008)., *Mechanics of Materials,* NY: McGraw-Hill

Suggested Readings

1. R. C. Hibbeler,(2000) *Mechanics of Materials.* NJ: Prentice Hall
2. P. P. Benham& R. J. Crawford,(2004) *Mechanics of Engineering Materials,* London: Longman

ME-227 **Mechanics of Materials Lab** **1(0+1)**

Upon successful completion of the course, the student will be able to understand methods to demonstrate the basic concepts of Mechanics of Materials by applying them to various problems Analyze relevant Mechanical Systems by applying fundamental knowled.ge. Strength of materials, also called. mechanics of materials, deals with the behavior of solid objects subject to stresses and strains. The complete theory began with the consideration of the behavior of one- and two-dimensional members of structures, whose states of stress can be approximated. as two dimensional and was then generalized. to three dimensions to develop a more complete theory of the elastic and plastic behavior of materials. The study of strength of materials often refers to various methods of calculating the stresses and strains in structural members, such as beams, columns, and shafts. The methods employed. to pred.ict the response of a structure under loading and its susceptibility to various failure modes takes into account the properties of the materials such as its yield strength, ultimate strength, Young's modulus, and Poisson's ratio.

Contents

1. To study the Layout of Mechanics of Material Lab
2. Calculate the deflection of simply supported. beam with point load applied. at mid span. Also compare it with theoretical value.
3. To calculate the deflection of cantilever beam when a point load is applied. at its free end and compares it with the theoretical values.
4. To find the deflection of set of curved. bar of known geometry. Also compare the empirical data with result of calculated. form
5. To study Polaris cope, its operation and applications
6. To determine stresses in an internally pressurized. thin walled. cylinder and compare it with theoretical data. Also find out poison ratio
7. To investigate the radial and hoop stresses in thick walled. cylinder of an internally pressurized. cylinder
8. To investigate the characteristics of a spiral spring. Determine the spring stiffness of various length of spring. Stiffness as shown at the time of vibration is proportional to vibrating mass
1. To determine the behavior of unsymmetrical cantilever beam

Recommended Texts

1. Lab Manual

Suggested Readings

1. R. C. Hibbeler,(2000) *Mechanics of Materials.* NJ: Prentice Hall
2. P. P. Benham& R. J. Crawford,(2004) *Mechanics of Engineering Materials*, London: Longman

ME-228 **Fluid Mechanics-I** **3(3+0)**

Fluid mechanics is the branch of physics concerned. with the mechanics of fluids (liquids, gases, and plasmas) and the forces on them. It has applications in a wide range of disciplines, that includes mechanical, civil, chemical and biomed.ical-engineering, geophysics, oceanography, astrophysics and biology. It can be divided. into fluid statics, the study of fluids at rest; and fluid dynamics, the study of the effect of forces on fluid motion. It is a branch of continuum mechanics, a subject which models matter without using the information that it is made out of atoms; that is, it models matter from a macroscopic viewpoint rather than from microscopic. Fluid mechanics, especially fluid dynamics, is an active field of research, typically mathematically complex. Many problems are partly or wholly unsolved. and are best addressed. by numerical methods, typically using computers. A modern discipline, called. computational fluid dynamics (CFD), is devoted. to this approach. Particle image velocimetry, an experimental method for visualizing and analyzing fluid flow, also takes advantage of the highly visual nature of fluid flow.

Contents

1. Fluid Properties, Definition of fluid and its classification, Concept of continuum. Properties of the fluid.
2. Fluid Statics, Concept of Pressure and basic equations for compressible and incompressible. Pressure measurements and devices., Hydrostatics forces on plane and curved. surfaces., Buoyancy and Stability.Pressure variation in fluid with rigid body motion.
3. Fluid Kinematics
a. Flow characteristics, Descriptions of Velocity and acceleration field (Streamlines, streak lines and path lines).Control volume and representation of system.Reynolds transport theorem (RTT
4. Fluid Dynamics, Application of Newton’s 2nd law in fluids.Total, stagnation and dynamic pressure., Deriving Bernoulli equation and its applications
5. Integral Analysis of Fluid Flow. Continuity equation using RTT.Linear momentum equation using RTT., Moment of momentum equation using RTT.
6. Dimensional Analysis, Similitude and Modeling, Dimensional analysis, Buckingham Pi theorem and determination of Pi terms
7. Flow in Pipes, Characteristics of pipe flow laminar and turbulent.Calculating friction factor and wall shear stresses. Solving pipe flow network problems

Recommended Texts

1. John F. Douglas, (2000), fluid Mechanics, (6th ed.). NJ: Prentice Hall
2. Munson, Young A and Okiishi HT,J (2008), *Fundamentals Of Fluid Mechanics*. NJ: J. Wiley & Sons.

Suggested Readings

1. Philip J. Pritchard and John C. Leylegian, (2012) *Fox and McDonald's Introduction to Fluid Mechanics*. NJ: J. Wiley & Sons.
2. Frank M White, (2002)*Fluid Mechanics*. NY: McGraw-Hill.

ME-229 **Thermodynamics Lab** **1(0+1)**

Thermodynamics, science of the relationship between heat, work, temperature, and energy. In broad terms, thermodynamics deals with the transfer of energy from one place to another and from one form to another. The key concept is that heat is a form of energy corresponding to a definite amount of mechanical work. The most important laws of thermodynamics are, the zeroth law of thermodynamics, the first law of thermodynamics, or the law of conservation of energy, the second law of thermodynamics, the third law of thermodynamics. Although thermodynamics developed. rapidly during the 19th century in response to the need. to optimize the performance of steam engines, the sweeping generality of the laws of thermodynamics makes them applicable to all physical and biological systems. In particular, the laws of thermodynamics give a complete description of all changes in the energy state of any system and its ability to perform useful work on its surroundings.

Contents

1. Experiments related. to Thermodynamics I and II will be covered.
2. Teaching Methodology , Lecturing , Demonstration
3. Assessment .Lab Exam (Written/Practical Assessments), Lab Reports, Lab Assignments, Lab Session Performance, Problem Based. Learning/Open Ended. Lab Assessment (Optional)

Recommended Texts

1. Yunus A. Cengel and Michael A. Boles, (2010) Thermodynamics, An Engineering Approach, NY: McGraw-Hill.
2 T.D. Eastop and A. McConkey, (2004) Applied. Thermodynamics for Engineering Technologists, UK: Pearson.

Suggested Readings

1 .Sonntang, B, and Van W, (212) *Fundamentals of Thermodynamics*. NJ: John Wiley & Sons.
2. Ibrahim D. and Marc A. Rosen (2006), *Exergy: Energy, Environment, and Sustainable Development.* NY: Springer.
3. Moran M. J. and Shapiro H. O. (2010), *Fundamentals of Engineering Thermodynamics.* NJ: John Wiley & Sons.

MATH-221 **Mathematics-IV** **3 (2+1)**

This course analyzed. the basic techniques for the efficient numerical solution of problems in science and engineering. Topics spanned. root finding, interpolation, and approximation of functions, integration, differential equations, direct and iterative methods in linear algebra. The overall goal of the field of numerical analysis is the design and analysis of techniques to give approximate but accurate solutions to hard problems, the variety of which is Suggested. by the following, advanced. Numerical methods are essential in making numerical weather pred.iction feasible and computing the trajectory of a spacecraft requires the accurate numerical solution of a system of ordinary differential equations. Practical mathematics has been a human activity from as far back as written records exist. The research required. to solve mathematical problems can take years or even centuries of sustained. inquiry. Mathematics is essential in many fields, including natural science, engineering, med.icine finance, and the social sciences. Applied. Mathematics has led. to entirely new mathematical disciplines, such as statistics and game theory. Mathematicians engage in pure mathematics (mathematics for its own sake) without having any application in mind, but practical applications for what began as pure mathematics are often discovered. later

Contents

1. Error and computer arithmetic
2. Root-finding for non-linear equations
3. Interpolation and polynomial approximation
4. Solution of system of linear equations
5. Numerical differentiation and integration
6. Numerical solution of ordinary differential equations.

Recommended. Texts

2 Chan S. Park, Murray R. Spiegel. (2009). *Complex Variables*. NY: McGraw-Hill Ed.ucation

Suggested. Readings

1. Scheid, (1989). *Numerical Analysis.* NY: McGraw-Hill Ed.ucation

ME-311 **Fluid Mechanics-II** **3 (3+0)**

Fluid mechanics is the branch of physics concerned. with the mechanics of fluids (liquids, gases, and plasmas) and the forces on them. It has applications in a wide range of disciplines, that includes mechanical, civil, chemical and biomed.ical-engineering, geophysics, oceanography, astrophysics and biology. It can be divided. into fluid statics, the study of fluids at rest; and fluid dynamics, the study of the effect of forces on fluid motion. It is a branch of continuum mechanics, a subject which models matter without using the information that it is made out of atoms; that is, it models matter from a macroscopic viewpoint rather than from microscopic. Fluid mechanics, especially fluid dynamics, is an active field of research, typically mathematically complex. Many problems are partly or wholly unsolved. and are best addressed. by numerical methods, typically using computers. A modern discipline, called. computational fluid dynamics (CFD), is devoted. to this approach. Particle image velocimetry, an experimental method for visualizing and analyzing fluid flow, also takes advantage of the highly visual nature of fluid flow.

Contents

1. Differential Analysis of Fluid Flow: Deriving continuity equation by applying conservation of mass principle.
2. Evaluating velocity and acceleration field using material derivative.
3. Deriving Navier-Stokes equation and some simple analytical solution
4. Potential flow theory: Concept of vorticity, Circulation, Inviscid and Irrotational flow field
5. Basic velocity potential function and its superposition.
6. Pred.iction of Lift and drag using potential flow theory
7. Flow over immersed. bodies: Boundary layer theory and its thicknesses.
8. Concept of local and average drag coefficient.
9. Calculating drag and lift forces due to pressure and velocity field.
10. Introduction to Computational Fluid Dynamics: Finite difference formulation
11. Solving basic fluid flow problems using available CFD code.
12. Compressible Flows: Mach number and speed. of sound
13. Isentropic flow of an ideal gas
14. Convergent divergent Nozzle
15. Turbomachinery: Fans, Pumps, turbines and other flow devices.
16. Deriving Euler's equation and solving of turbo-machine problems using velocity triangle
17. Pump and turbine performance characteristic curves.

Recommended Texts

1. HT John, HT (2013). Fundamentals Of Fluid Mechanics (7th ed.). NJ: J. Wiley & Sons.
2. Pritchard, P.J (2011).Introduction To Fluid Mechanics (8th ed.). NJ: J.Wiley & Sons.

Suggested Readings

1. White, F.M (2011). Fluid Mechanics (7th ed.). NY: Mc-Graw Hill

ME-317 **Heat and Mass Transfer** **3 (3+0)**

The main aim of this course is the study of heat and mass transfer phenomenon. The course will give an introductory treatment of the governing laws for heat and mass transfer. The following topics are covered.: Steady state and transient conduction, fundamentals and engineering treatment of convection heat transfer, heat transfer with phase change (boiling/condensation), radiation heat transfer and heat exchangers. Both analytical and numerical solution methods are presented. Mass transfer is the net movement of mass from one location, usually meaning stream, phase, fraction or component, to another. Mass transfer occurs in many processes, such as absorption, evaporation, drying, precipitation, membrane filtration, and distillation. Mass transfer is used. by different scientific disciplines for different processes and mechanisms. Some common examples of mass transfer processes are the evaporation of water from a pond to the atmosphere, the purification of blood in the kidneys and liver, and the distillation of alcohol. In industrial processes, mass transfer operations include separation of chemical components in distillation columns, absorbers such as scrubbers or stripping, adsorbers such as activated. carbon bed.s, and liquid-liquid extraction.

Contents

1. Introduction to Heat transfer: Review of the concepts of equilibrium, steady state, heat and thermodynamics.
2. Basic modes of heat transfer and their mechanisms.
3. Conduction: Deriving heat conduction equation using principle.
4. Solving heat conduction problems using equivalent electrical networks.
5. Extended. surfaces and their performance parameters.
6. Transient heat conduction and lumped. heat capacity method and its corresponding electrical analogy.
7. Radiation: Fundamental characteristics of thermal radiation and surfaces
8. Laws of black body radiation
9. Intensity of radiation
10. Solving problems of radiative heat transfer between surfaces and enclosures using equivalent electrical networks.
11. Convection: Deriving energy equation for convection
12. Heat transfer rate for laminar, turbulent and mixed. boundary layers for external flow and internal flow problems.
13. Buoyancy driven flows and their heat transfer rate for external flow problems and enclosed. spaces.
14. Heat transfer rate for phase change processes i.e. Boiling and condensation.
15. Heat Exchangers: Classification and types of Heat exchangers.
16. LMTD method and NTU-effectiveness method
17. Mass transfer: Fick's law of diffusion and mass diffusivity.
18. Concept of concentration boundary layer.
19. Solving mass transfer problems using convective heat transfer analogy.

Recommended Texts

1. Holman, J.P (2009). *Heat transfer* (10th ed.). New York: McGraw-Hill ed.ucation.
2. Cengel, Y.A (2015). *Heat and Mass Transfer* (5th ed.). New York: McGraw-Hill ed.ucation.

Suggested Readings

1. Incropera & DeWitt (2017). *Fundamentals of Heat Transfer* (8th ed.) NJ: John Wiley & Sons
2. Frank, K. (2016). *Elements of Heat Transfer* (4th ed.) US: International Textbooks Co.

ME-314 **Machine Design II** **2 (2+0)**

Machine Design is the innovation of new and effective machines and improving the existing ones. A new or effective machine is one which is more economical in the overall cost of production and operation. The design is to formulate a plan for the satisfaction of a human need. In designing a machine component, it is necessary to have a good knowled.ge of many subjects such as Mathematics, Engineering Mechanics, Strength of Materials, Theory of Machines, Workshop Processes and Engineering Drawing. The design is to formulate a plan for the satisfaction of a human need. In designing a machine component, it is necessary to have a good knowled.ge of many subjects such as Mathematics, Engineering Mechanics, Strength of Materials, Theory of Machines, Workshop Processes and Engineering Drawing. . Consider a machine is produced. without carrying out the designing process. Then, there will be no data available regarding the machine and it may breakdown at any time without any prior indication. The reason for the failure cannot be identified. and also, no repair work can be done on the machine. It is difficult to find the working load of a machine as the material used. in the machine components and the reaction forces acting between the machine components may not be known

Contents

1. Selection of bearings: Selection proced.ures of sliding contact bearings and rolling contact bearings
2. Design of Brake / Clutches: Different types of clutches and designing concepts
3. Different types of brakes and designing concepts
4. Design of Power Screws / Translation Screws: Introduction to power / translational screws
5. Stresses in power / translational screws
6. Efficiency of power / translational screws
7. Applications of power / translational screws
8. Selection of Standard Machine Elements: Selection of flat belts, V belts, chain drive and rope drives

Recommended Texts

1. Mott, R.L. (2019). *Machine Elements in Mechanical Design* (6th ed.). UK: Pearson
2. Norton (2000). *Design of Machinery* (2nd ed.). New York: McGraw-Hill ed.ition.

Suggested Readings

1. Shigley, J.E. (2014). *Theory of Machines & Mechanisms* (6th ed.). UK: Oxford press.

ME-315 **Machine Design II Lab** **1 (0+1)**

The main aim of this lab is to study 3D modeling software i.e. Pro Engineer wildfire for 2D and 3D drawings. At the end of the lab students will be able to understand different techniques used. for drawing in 2D and 3D for this softwareMachine Design is the innovation of new and effective machines and improving the existing ones. A new or effective machine is one which is more economical in the overall cost of production and operation. The design is to formulate a plan for the satisfaction of a human need. In designing a machine component, it is necessary to have a good knowled.ge of many subjects such as Mathematics, Engineering Mechanics, Strength of Materials, Theory of Machines, Workshop Processes and Engineering Drawing.

Contents

1. To study 3D modeling software i.e. Pro Engineer wildfire for 2D and 3D drawings. At the end of the lab students will be able to understand different techniques used. for drawing in 2D and 3D for this software.
2. The lab majorly emphasis on the learning of primitives of software, solid modeling, surface modeling , wire frame modeling, 2D drawings, creating and assembling of mechanical parts. This software allows student to produce accurate drawings quickly and to save, revisit, ed.it, and print them and streamlining the workflow.

Recommended Texts

1. Mott, R.L. (2019). *Machine Elements in Mechanical Design* (6th ed.). UK: Pearson
2. Norton (2000). *Design of Machinery* (2nd ed.). New York: McGraw-Hill ed.ition.

Suggested Readings

1. Shigley, J.E. (2014). *Theory of Machines & Mechanisms* (6th ed.). UK: Oxford press.

ME-313 **Manufacturing Processes** **3 (3+0)**

Manufacturing engineering or manufacturing process are the steps through which raw materials are transformed. into a final product. The manufacturing process begins with the product design, and materials specification from which the product is made. These materials are then modified. through manufacturing processes to become the required. part. Manufacturing process is that part of the production process which is directly concerned. with the change of form or dimensions of the part being produced. It does not include the transportation, handling or storage of parts, as they are not directly concerned. with the changes into the form or dimensions of the part produced. Modern manufacturing includes all intermed.iate processes required. in the production and integration of a product's components. Some industries, such as semiconductor and steel manufacturers use the term fabrication instead. The manufacturing sector is closely connected. with engineering and industrial design. Examples of major manufacturers in North America include General Motors Corporation, General Electric, Procter & Gamble, General Dynamics, Boeing, Pfizer Precision Castparts And FCA

Contents

1. Introduction: Basic concepts of manufacturing processes.
2. Casting and Moulding: Metal casting processes and equipment.
3. Powder metallurgy, Plastics
4. Forming: Extrusion and drawing, sheet metal forming, forming and shaping plastics and composite materials
5. Machining: Conventional and non-conventional machining processes
6. Joining: Welding, brazing, soldering, sintering, adhesive bonding, fastening, Press fitting
7. Additive Manufacturing: 3D Printing

Recommended Texts

1. Mikell P.G (2019).*Fundamental of Modern Manufacturing: Materials, Processes and Systems*, (Latest ed.) NJ: John Wiley
2. S. Kalpakjian & S. R. Schmid, (2018). *Manufacturing Processes for Engineering Materials*, UK: Pearson

Suggested Readings

1. Stanley A. K, Ann E. Lawson & Andrew C. H, (2018). Manufacturing Technology, NY: McGraw-Hill

ME-319 **Manufacturing Processes Lab** **1 (0+1)**

The subject of Manufacturing Processes provides an important institutional foundation for learning and developing process skills and capabilities that are increasingly intertwined. with core R&D in some of the industries, most important to the country's economic future. These materials are then modified. through manufacturing processes to become the required. part. Manufacturing process is that part of the production process which is directly concerned. with the change of form or dimensions of the part being produced. It does not include the transportation, handling or storage of parts, as they are not directly concerned. with the changes into the form or dimensions of the part produced. Modern manufacturing includes all intermed.iate processes required. in the production and integration of a product's components. Some industries, such as semiconductor and steel manufacturers use the term fabrication instead. The manufacturing sector is closely connected. with engineering and industrial design. Examples of major manufacturers in North America include General Motors Corporation, General Electric, Procter & Gamble, General Dynamics, Boeing, Pfizer Precision Castparts And FCA

Contents

1. Conventional Machining Processes
2. Lathe Machine, Introduction to Lathe Machine
3. Feed. mechanism of Lathe Machine, Operations performed. on Lathe machine
4. Facing, Turning, Rough Turning, Finish Turning, Shoulder Turning Taper Turning
5. Drilling and Boring, Milling Machine, Introduction to Milling Machine
6. Feed. mechanism of Milling Machine, Operations performed. on Milling machine, Plain Milling, Angular Milling, Face Milling, Form Milling
7. Drilling and boring on Milling Machine, Casting Process, Introduction to Casting, Casting Proced.ure, Forming Process, Introduction to Forming
8. Extrusion forming, Joining process, Welding Process

Recommended Texts

1. Mikell P.G (2019).Fundamental of Modern Manufacturing: Materials, Processes and Systems. NJ: John Wiley
2. S. Kalpakjian & S. R. Schmid, (2018). Manufacturing Processes for Engineering Materials. UK: Pearson
3. Lab Manuals

Suggested Readings

1. Stanley A. K, Ann E. Lawson & Andrew C. H, (2018). Manufacturing Technology. NY: McGraw-Hill

ME-320 **Fluid Mechanics Lab** **1 (0+1)**

The main aim of this lab is to understand methods to demonstrate the basic concepts of Fluid Mechanics by applying them to various problems. Analyze relevant Mechanical Systems by applying fundamental knowled.ge. Fluid mechanics is the branch of physics concerned. with the mechanics of fluids (liquids, gases, and plasmas) and the forces on them. It has applications in a wide range of disciplines,thatincludes mechanical, civil, chemical and biomed.icalengineering, geophysics, oceanograph y, astrophysics and biology. It can be divided. into fluid statics, the study of fluids at rest; and fluid dynamics, the study of the effect of forces on fluid motion. It is a branch of continuum mechanics, a subject which models matter without using the information that it is made out of atoms; that is, it models matter from a macroscopic viewpoint rather than from microscopic. Fluid mechanics, especially fluid dynamics, is an active field of research, typically mathematically complex. Many problems are partly or wholly unsolved. and are best addressed. by numerical methods, typically using computers.

Contents

1. Flow measurement with the help of rotameter
2. Flow measurement with the help of venturi meter
3. Determine the Cd factor in venturi meter
4. Calibration of bourdan tube pressure gauge
5. Determine the Cd, Cv, Cc through orifice
6. Efficiency of hydraulic ram pump
7. Energy loss in bends and fittings pipe
8. Energy loss in bends and fittings pipe through gate valve
9. Impact of jet
10. Pump connected. in series
11. Pump connected. in parallel
12. Impulse turbine
13. Reaction Turbine

Recommended Texts

1. HT John, HT (2013). *Fundamentals of Fluid Mechanics* (7th ed.). NJ: Wiley & Sons.
2. Pritchard, P.J (2011). *Introduction to Fluid Mechanics* (8th ed.). NJ: Wiley & Sons.
3. Lab Manuals

Suggested Readings

1. White, F.M (2011). *Fluid Mechanics* (7th ed.). NY: Mc-Graw Hill

ENG-312 Technical Report Writing and Presentation Skills 2 (1+1)

This course component has been designed. for the students of engineering keeping in view of the need.s of English language and its growing need.s in our society. In this course the students will be familiarized. with the usage of language in both written and spoken domain. The students will be introduced. to the usage of language composition and its functional need.s in this changing world scenario. The major focus of this technical writing course is the technical report. Just about everything you study, everything you write, is geared. toward preparing you to write this final report. The early, short assignment involving instructions or descriptions and the like give you practice using headings, lists, notices, and graphics; in handling numbers and abbreviations; and of course, in producing good, clear, well-organized. Writing. For many students, the technical report is the longest document they've ever written. It normally involves some research; often the information comes not only from published. sources in the library, but also sources outside the library, including non-published. things such as interviews, correspondence, and video tapes. It may also be the fanciest document: it uses binding and covers and has special elements such as a table contents, title page, and graphics.

Contents

1. Essay writing: Descriptive, narrative, discursive, argumentative
2. Academic writing: How to write a proposal for research paper/term paper
3. How to write a research paper/term paper (emphasis on style, content, language, form, clarity, consistency)
4. Technical Report writing
5. Progress report writing

Recommended Texts

1. White. R (1992). Essay Writing and Academic Writing Advanced. (3rd ed.). UK: Oxford University Press.
2. Langan. J (2004). College Writing Skills (3rd ed.). NY: McGraw-Hill Higher ed.ition

Suggested Readings

1. Mandel. S.R. (2006). Patterns of College Writing (4th ed.). UK: St. Martin’s Press.

STAT-321 **Engineering Statistics** **(3+0)**

To provide necessary statistical background for analyzing data and drawing inferences from that analysis. To increase the student's mastery of the ded.uctive nature of reasoning. To understand the nature of critical thinking. Statistics is the discipline that concerns the collection, organization, analysis, interpretation and presentation of data. In applying statistics to a scientific, industrial, or social problem, it is conventional to begin with a statistical population or a statistical model to be studied. Populations can be diverse groups of people or objects such as "all people living in a country" or "every atom composing a crystal". Statistics deals with every aspect of data, including the planning of data collection in terms of the design of surveys and experiments.[4] See glossary of probability and statistics. When census data cannot be collected., statisticians collect data by developing specific experiment designs and survey samples. Representative sampling assures that inferences and conclusions can reasonably extend from the sample to the population as a whole. An experimental study involves taking measurements of the system under study, manipulating the system, and then taking additional measurements using the same proced.ure to determine if the manipulation has modified. the values of the measurements. In contrast, an observational study does not involve experimental manipulation.

Contents

1. Describe methods (frequency distributions and graphing and measures of location and variation)
2. Basic probability theory (sample spaces, counting, factorials, combinations, permutations and probability laws)
3. Probability distributions (normal distributions and normal curve, binomial distribution, and random samples and sampling techniques)
4. Statistical interference (estimate, hypothesis testing, t-test and chi-square test, and errors)
5. Correlation and regression F-test and analysis of variance

Recommended Texts

1. Allan G. Bluman. P,(2004) *Elementary Statistics, A Step by Step Approach.* NY: McGraw
2. Douglas C. Montgomery and George C. Runger, (2008) *Applied. Statistics and Probability for Engineers*, (6th ed.). NJ: wiley & sons.

Suggested Readings

1. Douglas C. Montgomery and George C. Runger, (2008) *Applied. Statistics and Probability for Engineers*, (6th ed.). NJ: Wiley & sons.
2. Allan G. Bluman. P, (2004) *Elementary Statistics, A Step by Step Approach.* NY: McGraw

ECOM-322 **Engineering Economics** **2(2+0)**

Engineering is the profession in which knowled.ge of the mathematical and natural sciences gained. by study experience and practice is applied. with judgment to develop ways to utilize economically the material and forces of nature for the benefit of mankind. Engineering Economics is a subject of vital importance to Engineers. This subject helps one understand the need. for the knowled.ge of Economics for being an effective manager and decision maker. Engineering economics, previously known as engineering economy, is a subset of economics concerned. with the use and "...application of economic principles in the analysis of engineering decisions. As a discipline, it is focused. on the branch of economics known as microeconomics in that it studies the behavior of individuals and firms in making decisions regarding the allocation of limited. resources. Thus, it focuses on the decision-making process, its context and environment. It is pragmatic by nature, integrating economic theory with engineering practice.

Contents

1. Introduction
2. Engineering Costs
3. Estimation Models & Cash Flow Diagram, Life cycle cost
4. Time value of Money
5. Time value of money, equivalence, use of spread sheet, simple and compound interest
6. Uniform series & Arithmetic & geometric gradient, Nominal & effective, continuous compounding Economic criteria, Present Worth, future worth and annuity
7. Rate of Return
8. Minimum acceptable rate of return(MARR),Internal rate of return, External rate of return
9. Choosing the best alternative Incremental Analysis
10. Benefits and Cost ratio and Payback period Benefit and cost ratio (B/C Ratio), discounted. benefit and cost ratio, Simple payback period, discounted. payback period, Sensitivity & breakeven analysis
11. Principle of comparative advantage
12. Depreciation
13. Depreciation, Depreciation using Unit of Production
14. Depreciation using straight line method, Depreciation using Depletion
15. Taxes
16. Income Taxes, After tax RoR
17. Replacement analysis
18. Design life, salvage value, Up gradation Vs replacement
19. Risk and Uncertainty
20. Estimation of future events, Monte Carlo Simulation
21. Bayes theorem
22. Concepts of Imports and Exports
23. Basic concepts of import and export, Dumping and anti-dumping and related. laws

Recommended Texts

1. William G. Sullivan and Elin M. (2012) *Wicks, Estimation of future events.* NJ: Prentice Hall
2. Fraser N. M. and Jewkes E. M.,(2006), *Engineering Economics: Financial Decision Making for Engineers.* UK: Pearson

Suggested Readings

1. Tarquin J., Blank L. T. (2006), Engineering Economy, NY: McGraw-Hill

ME-323 Instrumentation and Measurement 2(2+0)

Instrumentation is a collective term for measuring instruments that are used. for indicating, measuring and recording physical quantities. The term has its origins in the art and science of scientific instrument-making. Instrumentation can refer to devices as simple as direct-reading thermometers, or as complex as multi-sensor components of industrial control systems. Today, instruments can be found in laboratories, refineries, factories and vehicles, as well as in everyday household use (e.g., smoke, detectors and thermostats). This course covers the basic use and application of sensors, transducers and electronic measuring instruments. The theory of analogue DC and AC measuring instruments is first established. which is then used. to study analog electronic and digital meters. Different types of sensors and transducer are studied. with their analog and digital interfacing. The use and application of different measuring instruments are also covered. Instrumentation is a collective term for measuring instruments that are used. for indicating, measuring and recording physical quantities. The term has its origins in the art and science of scientific instrument-making. Instrumentation can refer to devices as simple as direct-reading thermometers, or as complex as multi-sensor components of industrial control systems. Today, instruments can be found in laboratories, refineries, factories and vehicles, as well as in everyday household use (e.g., smoke detectors and thermostats)

Contents

1 Introduction to measurement and instrumentation**.**
a. Significance of measurement,
b. planning of experiments,
c. general measurement system,
d. calibration
2 Static and dynamic characteristics of instruments**:**
a. measurement sensitivity,
b. range, accuracy, precision, repeatability, and uncertainty of instruments,
c. measurement errors
3 Measurement
a. length, displacement, force,
b. torque, strain, frequency,
c. Pressure, flow, and temperature.
4 Introduction to data acquisition systems**,**
a. Signal conditioning,
b. display elements

Recommended Texts

1. Doeblin E.(2010) , *Measurement Systems Applications and Design*, NY: McGraw Hill
2. Alciatore D. G., Histand M. B. (2008), *Introduction to Mechatronics and Measurement Systems*. NY: McGraw Hill

Suggested Readings

1. Doeblin E.(2008), *Measurement Systems Applications and Design*, NY: McGraw Hill
2. Alciatore D. G., Histand, M. B. (2010), *Introduction to Mechatronics and Measurement Systems*. NY: McGraw Hill

ME-324 Instrumentation and Measurement Lab 1(0+1)

Instrumentation is a collective term for measuring instruments that are used. for indicating, measuring and recording physical quantities. The term has its origins in the art and science of scientific instrument-making. Instrumentation can refer to devices as simple as direct-reading thermometers, or as complex as multi-sensor components of industrial control systems. Today, instruments can be found in laboratories, refineries, factories and vehicles, as well as in everyday household use (e.g., smoke, detectors and thermostats). This course covers the basic use and application of sensors, transducers and electronic measuring instruments. The theory of analogue DC and AC measuring instruments is first established. which is then used. to study analog electronic and digital meters. Different types of sensors and transducer are studied. with their analog and digital interfacing. The use and application of different measuring instruments are also covered. Instrumentation can refer to devices as simple as direct-reading thermometers, or as complex as multi-sensor components of industrial control systems. Today, instruments can be found in laboratories, refineries, factories and vehicles, as well as in everyday household use (e.g., smoke detectors and thermostats)

Contents

1. Experiments related. to the Instrumentation and Measurement will be covered.
2. Teaching Methodology, Demonstration ,Lab Report Writing
2. Assessment, Lab performance, Quizzes, Lab Report, Lab Exams, Lab Assignments

Recommended Texts

1. Doeblin E.(2010) , *Measurement Systems Applications and Design.* NY: McGraw Hill
2. Alciatore D. G., Histand M. B. (2008), *Introduction to Mechatronics and Measurement Systems*. NY: McGraw Hill

Suggested Readings

1. Doeblin E.(2008), *Measurement Systems Applications and Design*, NY: McGraw Hill
2. Alciatore D. G., Histand, M. B. (2010), *Introduction to Mechatronics and Measurement Systems*. NY: McGraw Hill

ME-325 **Mechanics of Machines** **3(3+0)**

The course aims at strengthening the knowled.ge of the structure of machines and mechanisms with particular attention to the kinematic, kinetic static and dynamic analysis of systems with rigid links and to the dynamics of cycle machines. Advanced. Methods of analysis and synthesis of mechanisms, cams and gears will complement the basic concepts developed. at the bachelor level. Elements of machine design and strength of materials are also presented. with emphasis to fatigue analysis and structural analysis. At the end of the course students have a deep understanding of all the elements of mechanics that are fundamental for industrial automation, mastering design and construction principles that play a role in modern automatic machines. A machine (or mechanical device) is a mechanical structure that uses power to apply forces and control movement to perform an intended. action. Machines can be driven by animals and people, by natural forces such as wind and water, and by chemical, thermal, or electrical power, and include a system of mechanisms that shape the actuator input to achieve a specific application of output forces and movement..

Contents

1. Introduction to Mechanisms
a. Machine & Mechanisms, Mechanism Terminology, Kinematic Diagram, Kinematic Inversion,
b. Four Bar Mechanism, Slider Crank, Mechanism, Techniques of Mechanism Analysis
2. Vector, Position and Displacement Analysis
a. Motion, Vectors, Analytical Vector Methods Applied. to the displacement Analysis of Planar Linkages, Graphical Analysis, Complex-Number Methods Applied. to the Displacement ,Analysis of Linkages, Spatial (Three-Dimensional) Linkages, Computer Implemented. Numerical Methods of Position Analysis
3. Velocity Analysis of Mechanisms, Average Speed. in Mechanize Mechanism, Velocity of a Point in Mechanize Mechanism, Angular Velocity in Mechanize Mechanism, Motion of a Rigid Body about a Fixed. Axis (Without Translation),Moving Coordinate Systems and Relative Velocity, Application of Analytical Vector and Matrix Methods to Linkages, Four-Bar Linkage, Complex-Number Methods Applied. to Velocity Analysis
4. Acceleration Analysis of Mechanisms, Planar Motion, Spatial Motion, Relative Acceleration, Analysis of a Four-Bar Linkage by Analytical Vector Methods, Acceleration Analysis, Position Analysis, The Acceleration Polygon, Graphical Analysis of the Four-Bar Linkage, An Analytical Solution Based. on the Acceleration Polygon, Graphical Analysis of Sliding Contact Linkages, Trial Solution Method Applied. to Linkage Acceleration Analysis, Spatial Linkages, Acceleration Analysis of an RSSR
5. Design & Development, Mechanism Design Time Ratio, Timing Charts, Design of Slider Crank Mechanism, Design of Crank Shaper Mechanism, Mechanism to Move a Link, Between Two Positions , Design of Slider Crank Mechanism, Design of Crank Shaper Mechanism, Mechanism to Move a Link Between Two Positions
6. Cams Types of Cams & Followers, Follower Motion Schemes, Graphical Disk Cam Profile Design, Pressure Angle, Design Limitations
7. Governors, Types of Governors, Centrifugal Governors, Porter Governors, Parallel Governors, Spring Loaded. Governors Gears, Toothed. Gearing, Gear Trains

Recommended Texts

1. David H. Myszka, (2014), *Machines and Mechanisms*. UK: Pearson
2. John J. Uicker, Gordon R. Pennock, J. E (2008). Shigley, *Theory of Machines and Mechanisms.* UK: Oxford University Press.

Suggested Readings

1. Robert F.M (2003), *The Theory of Machines.* NY: McGraw Hill
2. Collins J. A.(2002), *Mechanical Design of Machine Elements and Machines,* NJ: J. Wiley

ME-326 Heating, Ventilating and Air Conditioning 3(3+0)

Heating, ventilation, and air conditioning (HVAC) is the technology of indoor and vehicular environmental comfort. Its goal is to provide thermal comfort and acceptable indoor air quality. HVAC system design is a sub discipline of mechanical engineering, based. on the principles of thermodynamics, fluid mechanics and heat transfer. "Refrigeration" is sometimes added. to the field's abbreviation, as HVAC&R or HVACR or "ventilation" is dropped., as in HACR (as in the designation of HACR-rated. circuit breakers). HVAC is an important part of residential structures such as single family homes, apartment buildings, hotels and senior living facilities, med.ium to large industrial and office buildings such as skyscrapers and hospitals, vehicles such as cars, trains, airplanes, ships and submarines, and in marine environments, where safe and healthy building conditions are regulated. with respect to temperature and humidity, using fresh air from outdoors. Ventilating or ventilation (the "V" in HVAC) is the process of exchanging or replacing air in any space to provide high indoor air quality which involves temperature control, oxygen replenishment, and removal of moisture, odors, smoke, heat, dust, airborne bacteria, carbon dioxide, and other gases.

Contents

1. Pure substance properties, important properties of saturated. and superheated. vapors, Properties of liquid-vapors mixtures
2. Refrigeration system basics, basics of vapors compression system, Pressure-enthalpy chart , coefficient of Performance, Cycle diagrams and the simple saturated. cycle, Single stage and multi-stage compression cycle, Steam jet refrigeration cycle, Air refrigeration cycle
3. Refrigeration system analysis, vapor absorption refrigeration cycle, Comparison of actual and theoretical refrigeration cycle, Heat pump, Types and properties of refrigerants, Condensers and evaporators, Compressors, Refrigerant flow control devices
4. Refrigeration load estimation (Refrigeration), Product load, Air Change load, Heat gain through walls, Internal heat gain
5. Psychrometric properties of air, Composition of air, Dalton's Law of partial pressure, Dew point temperature, Dry bulb and wet bulb temperatures, Psychrometric charts, Heating and humidification, Cooling and dehumidification
6. HVAC basics, Thermal Comfort and Indoor environment Health. Water and vapour mixture, Air ventilation, calculation of fresh air supply of a building, air handling unit for untreated. fresh air, Forced. convection based. air ventilator design, Air treatment fundamentals, indoor air quality
7. HVAC systems, Essential components design of central air-conditioning plant, Water chiller and water heater, Air handling unit, Chilled. water and hot water recirculation system, All-air systems basics, Single zone and reheat system, Variable Volume, Dual duct and multi-zone system
8. Heating and Cooling Load, Space heating and cooling load, Design conditions, Transmission heat losses, Infiltration, ventilation and other heat loss and gain sources, Thermal radiation, Solar irradiation, Heat gain through fenestrations, Design conditions, Internal heat gain

Recommended Texts

1. McQuiston, P. and Spitler, (2008). *Heating, Ventilating, and Air Conditioning Analysis and Design,* NJ: John Wiley & Sons
2. Stoecker W. F.(2005),*Refrigeration and Air Conditioning.* NY: McGraw Hill.

Suggested. Readings

1. Dossat, R. J., (2008), *Principles of Refrigeration*. NJ:John Wiley
2. Haines, R, Wilson W., Lewis,(2012), *HVAC Systems Design Handbook*, NY: McGraw-Hill Companies

ME-327 **Heat Transfer and HVAC Lab** **1(0+1)**

Heating, ventilation, and air conditioning (HVAC) is the technology of indoor and vehicular environmental comfort. Its goal is to provide thermal comfort and acceptable indoor air quality. HVAC system design is a sub discipline of mechanical engineering, based. on the principles of thermodynamics, fluid mechanics and heat transfer. "Refrigeration" is sometimes added. to the field's abbreviation, as HVAC&R or HVACR or "ventilation" is dropped., as in HACR (as in the designation of HACR-rated. circuit breakers). HVAC is an important part of residential structures such as single family homes, apartment buildings, hotels and senior living facilities, med.ium to large industrial and office buildings such as skyscrapers and hospitals. Ventilating or ventilation (the "V" in HVAC) is the process of exchanging or replacing air in any space to provide high indoor air quality which involves temperature control, oxygen replenishment, and removal of moisture, odors, smoke, heat, dust, airborne bacteria, carbon dioxide, and other gases.

Contents

1. To determine the Pressure, Enthalpy diagram of basic refrigeration system TH 520
2. To determine the COP actual and theoretical of basic refrigeration system TH 520 and draw a graph between actual and theoretical COP
3. To determine the mass flow rate of refrigerant (134-a) and pH diagram of Basic Refrigeration system TH520
4. To determine the performance of absorption refrigerator under load and draw a graph of ammonia condenser and evaporator from start up
5. To find the start sequence and system component temperature of an absorption and refrigeration cycle and a graph between operator and absorber from startup
6. To identify different processes within a forced. draught cooling Tower H893
7. To determine “End State” properties of the air and water from chart and table, and the applications of the steady flow equation to selected. systems to draw up energy and mass balances of cooling tower H893
8. To determine the effects of cooling load on “Wet bulb Approach” of H893
9. To determine the Pressure, Enthalpy diagram of Refrigeration trainer TH 527
10. To determine the COP actual and theoretical of Refrigeration trainer TH 527 and draw a graph between actual and theoretical COP
11. To determine the mass flow rate of refrigerant (134-a) and pH diagram Air to water heat pump TH527
12. To determine the COP actual and theoretical of Air to water heat pump TH 525 and draw a graph between actual and theoretical COP
13. To determine the mass flow rate of refrigerant (134-a) and pH diagram Air to water heat pump TH525

Recommended Texts

1. McQuiston, P. and Spitler, (2008). *Heating, Ventilating, and Air Conditioning Analysis and Design*, NJ: John Wiley & Sons
2. Stoecker W. F.(2005),*Refrigeration and Air Conditioning.* NY: McGraw Hill.

Suggested. Readings

1. Dossat, R. J., (2008), *Principles of Refrigeration*. NJ:John Wiley

2. Haines, R, Wilson W., Lewis,(2012), *HVAC Systems Design Handbook*, NY: McGraw-Hill Companies

E-328 Health, Safety and Environment 1(1+0)

Many people are interested. in an organization's approach to laboratory environmental health and safety (EHS) management including laboratory personnel; customers, clients, and students (if applicable); suppliers; the community; shareholders; contractors; insurers; and regulatory agencies. More and more organizations attach the same importance to high standards in EHS management as they do to other key aspects of their activities. High standards demand a structured. approach to the identification of hazards and the evaluation and control of work-related. risks. A comprehensive legal framework already exists for laboratory EHS management. This framework requires organizations to manage their activities in order to anticipate and prevent circumstances that might result in occupational injury, ill health, or adverse environmental impact. This chapter seeks to improve the EHS performance of organizations by providing guidance on EHS to integrate EHS management with other aspects of the organization. Many features of effective EHS management are identical to management practices advocated. by proponents of quality assurance and business excellence. The guidelines presented. here are based. on general principles of good management and are designed. to integrate EHS management within an overall management system By establishing an EHS management system, EHS risks are controlled. in a systematic proactive manner.

Contents

1. Introduction of Health and Safety: Industrial Safety: introduction objectives of Safety, Importance of Safety in an industry, Industrial accidents, Effects of accidents, Types of accidents incidence of fire. Fire prevention and control.
2. Techniques of Safety Management: Principles of accident prevention, hazard analysis. Legal, humanitarian and economic reason for action. Safety inspection proced.ures. Safety training, First aid and emergency proced.ures.
3. Environment and Health: Introduction: importance of clean environment, Scale of Environmental Pollution. Environmental Act. Health and Safety Act.
4. Atmospheric Pollution: Types of Atmospheric pollution, Their Causes and Effects on Human Health, Available Technologies for Controlling Pollution.
5. Industrial Waste: Solid Waste, Industrial Effluents and Waste Gases, waste treatment plants.
6. Noise Pollution: Measurement of Noise level, Effect of excessive noise on human health. Remed.ial Measures.
7. ISO Standards for Safety and Health and Environment

Recommended Texts

1. Ridley J. and Channing J. (2002), *Safety at Works*, Routled.ge.
2. Lockyer K. G.(2000), *Factory & Production Management*, UK: Pitman Publishing.

Suggested Readings

1. Ridley and Channing J.(2012), *Safety at Works*, Routled.ge.
2. Lockyer K. G.(2014), *Factory & Production Management*, UK: Pitman Publishing.

ME-411 Control Engineering 3 (3+0)

This course will focus on the analysis of linear dynamic systems and their control. The course will enable students to design effective feed.back control using a broad range of control design tools including mathematical modeling of system components, block diagram manipulation, Laplace transform, root locus, frequency domain and state space techniques. Students will study practical controllers such as the PID controller. The analysis aspect of the course is relevant to almost every other course in engineering. Automation is deeply embed.ded. in our society and a good understanding of controls is essential for all engineers. The practice uses sensors and detectors to measure the output performance of the process being controlled.; these measurements are used. to provide corrective feed.back helping to achieve the desired. performance. Systems designed. to perform without requiring human input are called. automatic control systems (such as cruise control for regulating the speed. of a car). Multi-disciplinary in nature, control systems engineering activities focus on implementation of control systems mainly derived. by mathematical modeling of a diverse range of systems.

Contents

1. Introduction: Basics of control system, Open-loop and closed.-loop control systems, Block diagram terminology, Example of system for block diagrams, Signal flow graphs
2. Dynamic System Modeling: Mechanical Translational & Rotational Systems, Electrical Active & Passive Systems, Electromechanical Systems, Conversion of Electrical System to Equivalent Mechanical Systems and vice versa, Thermal system and fluid systems
3. Laplace Transforms and Transfer Function
   Mason Gain Formula to find transfer function, Mason's formula application of electrical and mechanical systems, Development of nodal equations from signal flow graph, Development of signal flow graph from nodal equations
4. State Space Formulation
   State space formulation from differential equations, State Space formulation from block diagram and signal flow graphs, Control and Observer Canonical form of block diagrams and state space, Types of inputs like impulse, step, ramp and sinusoidal input, Solution of state space for different responses, System linearization and its applications
5. Time Response of 1st and 2nd Order System
   Time response of the 1st and 2nd order systems (impulse, step, ramp etc.), Time response characteristics, Frequency response of 1st and 2nd order systems, Time response of higher order systems
6. Study of System Stability
   Introduction to stability, Poles and Zeros concept, Ruth-Hurwitz stability criteria and its applications, Concept of Root-Locus
7. Root Locus Design
   Root Locus design, System stability by pole placement, Compensator Design (Lead and Lag Compensator), Design of PID Controller (P, PI and PID Controllers), different PID Controller Tuning method
8. Frequency Design
   Introduction to frequency plots, Bode Plots, System Stability using Bode Plot

Recommended Texts

1. Katsuhiko O, (2012) *Modern Control Engineering*. UK: Pearson
2. Norman S N,(2014) *Modern Control Engineering.* NY: McGraw Hill.

Suggested Readings

1. Charles P. & Royce H, (2015), *Feed.back Control Systems*, NY: Prentice-Hall.

ME-412 **Control Engineering Lab** **1 (0+1)**

This course will focus on the analysis of linear dynamic systems and their control. The course will enable students to design effective feed.back control using a broad range of control design tools including mathematical modeling of system components, block diagram manipulation, Laplace transform, root locus, frequency domain and state space techniques. Students will study practical controllers such as the PID controller. The analysis aspect of the course is relevant to almost every other course in engineering. Automation is deeply embed.ded. in our society and a good understanding of controls is essential for all engineers. The practice uses sensors and detectors to measure the output performance of the process being controlled.; these measurements are used. to provide corrective feed.back helping to achieve the desired. performance. Systems designed. to perform without requiring human input are called. automatic control systems (such as cruise control for regulating the speed. of a car). Multi-disciplinary in nature, control systems engineering activities focus on implementation of control systems mainly derived. by mathematical modeling of a diverse range of systems.

Contents

1. Experiments related. to the control Engineering will be covered.
2. Teaching Methodology, Demonstration, Lab Report Writing
3. Assessment, Lab performance, Quizzes, Lab Report, Lab Exams, Lab Assignments

Recommended Texts

1. Katsuhiko O, (2012) *Modern Control Engineering*. UK: Pearson
2. Norman S N,(2014) *Modern Control Engineering*. NY: McGraw Hill.

Suggested Readings

1. Charles P. & Royce H, (2015), *Feed.back Control Systems*, NY: Prentice-Hall.

ME-413 **Mechanical Vibrations** **3(3+0)**

Vibration is a mechanical phenomenon whereby oscillations occur about an equilibrium point. The word comes from Latin vibrationem ("shaking, brandishing"). The oscillations may be periodic, such as the motion of a pendulum—or random, such as the movement of a tire on a gravel road. Vibration can be desirable: for example, the motion of a tuning fork, the reed. in a woodwind instrument or harmonica, a mobile phone, or the cone of a loudspeaker. In many cases, however, vibration is undesirable, wasting energy and creating unwanted. sound. For example, the vibrational motions of engines, electric motors, or any mechanical device in operation are typically unwanted. Such vibrations could be caused. by imbalances in the rotating parts, uneven friction, or the meshing of gear teeth. Careful designs usually minimize unwanted. vibrations. In many cases, however, vibration is undesirable, wasting energy and creating unwanted. sound. For example, the vibrational motions of engines, electric motors, or any mechanical device in operation are typically unwanted. Such vibrations could be caused. by imbalances in the rotating parts, uneven friction, or the meshing of gear teeth. Careful designs usually minimize unwanted. vibrations.

Contents

1. Introduction
2. Fundamentals of Vibrations, Degrees of Freed.om
3. Discrete and Continuous Systems, SHM, Vibration Analysis Proced.ure
4. Single Degree of Freed.om Systems - Free Vibratory Systems
5. Newton's Method, Energy Method
6. Viscously Damped. Free Vibration
7. Logarithmic Decrement, Springs and dampers in Combination
8. Single Degree of Freed.om Systems – Forced. Vibratory Systems
9. Forced. Harmonic Vibration, Rotating Unbalance
10. Base Excitation, Vibration Isolation, Energy Dissipation by Damping
11. Whirling of Rotating shafts
12. Transient Vibration
13. Impulse Response Function, Response to an Arbitrary Input
14. Systems with Two Degrees of Freed.om
15. The Normal Mode Analysis, Free Vibration Analysis of an Undamped. Systems
16. Coordinate Coupling, Free Vibration Analysis of Damped. systems
17. Forced. Harmonic Vibration of an Undamped. Systems
18. Forced. Harmonic Vibration of Damped. Systems
19. Multi Degree of Freed.om Systems
20. Eigen Values and Eigen Vectors, Dunkerley's Method, Rayleigh's Method
21. Influence co-efficient, Matrix Iteration Method
22. Stodola's Method, Holzer's Method

Recommended Texts

1. Thomson W. T. and Dahleh M. D.(2005), *Theory of Vibration with Applications*, UK: Pearson
2. Rao S. S.(2008), *Mechanical Vibrations.* NJ: Prentice Hall

Suggested Readings

1. Inman D. J.(2010), *Engineering Vibration.* NJ: Prentice Hall

ME-414 **Internal Combustion Engines** **3(3+0)**

An internal combustion engine (ICE) is a heat engine in which the combustion of a fuel occurs with an oxidizer (usually air) in a combustion chamber that is an integral part of the working fluid flow circuit. In an internal combustion engine, the expansion of the high-temperature and high-pressure gases produced. by combustion applies direct force to some component of the engine. The force is applied. typically to pistons, turbine blades, rotor or a nozzle. This force moves the component over a distance, transforming chemical energy into useful work. The first commercially successful internal combustion engine was created. by Étienne Lenoir around 1860' and the first modern internal combustion engine was created. in 1876 by Nicolaus Otto (see *Otto engine*). The term *internal combustion engine* usually refers to an engine in which combustion is intermittent, such as the more familiar four-stroke and two-stroke piston engines, along with variants, such as the six-stroke piston engine and the Wankel rotary engine. A second class of internal combustion engines use continuous combustion: gas turbines, jet engines and most rocket engines, each of which are internal combustion engines on the same principle as previously described. Firearms are also a form of internal combustion engine.

Contents

1. Introduction to I.C engines, History of I.C engine development, Engine classifications
a. Engine components and terminologies
b. Working principle of turbo charged., supercharged. Engine its performance characteristics
2. SI & CI engines systems: Basic engine cycle and operation, Two and four stroke engines, Engine operating characteristics (engine speed., compression ratio, sfc, A/F, F/A, etc), Engine parameters (efficiency, MEP, Power, torque, etc), Carburetors, Fuel injectors, Ignition system, Electronic control unit, Engine management system, Otto, Diesel and Dual cycle and their comparison
3. Fuel and combustion, Hydrocarbon fuels and their properties, Thermochemistry and Chemical equilibrium, Self-ignition and engine knock, Ignition delay, Octane and Cetane Numbers
4. Gas exchange processes and mixture preparation:, Intake Manifold, Volumetric efficiency, Intake valves, Variable valve Control, Fuel injection, EFI systems (PFI, MPFI, GDI and Common rail), Super-charging and turbo-charging, Fluid Motion within combustion chamber, Turbulence, Swirl, Squish and Tumble, Crevice Flow and blowy
5. Combustion in SI and CI engines: Ignition and flame development, abnormal combustion and knock, Spark timing and Maximum brake torque spark timing, Diesel Fuel injection and mixture preparation, Phases of combustion and ignition delay, Injection timing, injection pressure, common rail fuel injection
6. Exhaust Flow, Turbocharging, Exhaust manifold, Exhaust gas recirculation
7. Pollution control, engine emissions, pollutant formation, after treatment, catalytic converters, soot traps
8. Heat Transfer in Engines and engine cooling system
9. Friction and Lubrication of engine, Lubrication systems

Recommended Texts

1. Pulkrabek W. W.(2010), *Engineering Fundamentals of IC engine*, USA: Pearson ed.ucation Inc,
2. Heywood J. B.(2013), *Internal Combustion Engine Fundamentals*, Heywood McGraw-Hill

Suggested Readings

1. Taylor C. F, (2016), *Internal combustion engines*. US: MIT Press.

ME-417 **Mechanisms and Mechanical Vibrations Lab** **1(0+1)**

Vibration is a mechanical phenomenon whereby oscillations occur about an equilibrium point. The word comes from Latin *vibrationem* ("shaking, brandishing"). The oscillations may be periodic, such as the motion of a pendulum—or random, such as the movement of a tire on a gravel road. Vibration can be desirable: for example, the motion of a tuning fork, the reed. in a woodwind instrument or harmonica, a mobile phone, or the cone of a loudspeaker. In many cases, however, vibration is undesirable, wasting energy and creating unwanted. Sound. In many cases, however, vibration is undesirable, wasting energy and creating unwanted. sound. For example, the vibrational motions of engines, electric motors, or any mechanical device in operation are typically unwanted. Such vibrations could be caused. by imbalances in the rotating parts, uneven friction, or the meshing of gear teeth. Careful designs usually minimize unwanted. vibrations. In many cases, however, vibration is undesirable, wasting energy and creating unwanted. sound.

Contents

1. To investigate the effect of small amplitude on time period of compound pendulum
2. To determine the radius of gyration of a compound pendulum
3. To verify that, the compound pendulum periodic time of oscillation for small amplitude
4. To measure the total time of simple pendulum using steal and wooden bob
5. To find the moment of inertia of irregular objects
6. To evaluate the static and dynamic test of mass spring apparatus
7. To measure the damping coefficient using free vibration apparatus
8. To measure force vibration frequency using force vibration apparatus without damper
9. To measure force vibration frequency using force vibration apparatus with damper
10. To find the value of ‘g’ by reversible pendulum.
11. To find the centre of precession of compound pendulum.
12. To find the frequency of lateral vibration without damping.
13. To find the moment of inertia of single rotor system and two rotor system.
14. Calculate the time period of single rotor vibration system.
15. Calculate the time period of Two rotor vibration system.
16. Calculate the frequency of Torsional vibration system**.**

Recommended Texts

1. Thomson W. T. and Dahleh M. D.(2005), *Theory of Vibration with Applications*. UK: Pearson
2. Rao S. S.(2008), *Mechanical Vibrations.* NJ: Prentice Hall

Suggested Readings

1. Inman D. J.(2010), *Engineering Vibration.* NJ: Prentice Hall

ME-421 **Introduction to Finite Element Analysis** **2(2+0)**

The Finite Element Analysis (FEA) is the simulation of any given physical phenomenon using the numerical technique called. Finite Element Method (FEM). Engineers use it to red.uce the number of physical prototypes and experiments and optimize components in their design phase to develop better products, faster while saving on expenses. It is necessary to use mathematics to comprehensively understand and quantify any physical phenomena such as structural or fluid behavior, thermal transport, wave propagation, the growth of biological cells, etc. Most of these processes are described. using Partial Differential Equations (PDEs). However, for a computer to solve these PDEs, numerical techniques have been developed. over the last few decades and one of the prominent ones, today, is the Finite Element Analysis. It is necessary to use mathematics to comprehensively understand and quantify any physical phenomena such as structural or fluid behavior, thermal transport, wave propagation, the growth of biological cells, etc. Most of these processes are described. using Partial Differential Equations (PDEs).

Contents

1. Introduction to FEA and Element Performance
2. Introduction to Finite Element Modeling and preliminary decisions
3. Elements types and their properties
4. Basic concepts of equilibrium & compatibility
5. General factors affecting element performance – Sources of errors
6. Convergence.
7. FE Methods, Shape Functions, Stiffness Matrix and Transformation
8. Direct Stiffness Method, Energy Methods
9. Shape Function: Linear and Quadratic Element
10. Beam Elements, Truss Elements, Linear and Planar elements
11. Stiffness matrix, Local to Global Co-ordinate Transformation Assembly
12. Static Structural Analysis
13. Modeling and analysis of 1D, 2D and 3D structures under static loading
14. Heat Transfer and Thermal Stress Analysis:
15. Introduction to Heat transfer, Thermal and Thermal Stress analysis concepts
16. Selection of Boundary Conditions based. on the identification of problem
17. Thermal Analysis (Steady State)
18. Thermal stress Analysi
19. Dynamic Analysis
20. Introduction to different types of dynamic analysis
21. Modal Analysis, Frequency Response Analysis, Transient Response Analysis, master's degrees of Freed.om

Recommended Texts

1. Richard G. Budynass, (2014), Advanced. Strength and Applied. Stress Analysis. New York: McGraw-Hill
2. Saeed. M,(2008), Finite Element Analysis – Theory and Applications with ANSYS. NJ: Prentice Hall.

Suggested Readings

1. Saeed. M,(2008) *Finite Element Analysis – Theory and Applications with ANSYS*. NJ: Prentice Hall.
2. Fagan M J,(2010), *Finite Element Analysis – Theory and Practice*. NY: Pearson.

ME-422 **Introduction to Finite Element Analysis Lab** **1(0+1)**

The Finite Element Analysis (FEA) is the simulation of any given physical phenomenon using the numerical technique called. Finite Element Method (FEM). Engineers use it to red.uce the number of physical prototypes and experiments and optimize components in their design phase to develop better products, faster while saving on expenses. It is necessary to use mathematics to comprehensively understand and quantify any physical phenomena such as structural or fluid behavior, thermal transport, wave propagation, the growth of biological cells, etc. Most of these processes are described. using Partial Differential Equations (PDEs). However, for a computer to solve these PDEs, numerical techniques have been developed. over the last few decades and one of the prominent ones, today, is the Finite Element Analysis. It is necessary to use mathematics to comprehensively understand and quantify any physical phenomena such as structural or fluid behavior, thermal transport, wave propagation, the growth of biological cells, etc. Most of these processes are described. using Partial Differential Equations (PDEs).

Contents

1. Study of a FEA package and modelling and stress analysis of : Bars of constant cross section area, tapered. cross section area and stepped. bar, Trusses – (Minimum 2 exercises of different types), Beams – Simply supported., cantilever, beams with point load, UDL, beams with varying load etc., (Minimum 6 exercises different nature), Stress analysis of a rectangular plate with a circular hole.
2. Thermal Analysis – 1D & 2D problem with conduction and convection boundary conditions (Minimum 4 exercises of different types), Dynamic Analysis to find a) Fixed. – fixed. beam for natural frequency determination, Bar subjected. to forcing function, Fixed. – fixed. beam subjected. to forcing function.
3. Demonstrate the use of graphics standards (IGES, STEP etc) to import the model from modeler to solver, Demonstrate one example of contact analysis to learn the proced.ure to carry out contact analysis, Demonstrate at least two different type of example to model and analyze bars or plates made from composite material.

Recommended Texts

1. Richard G. Budynass, (2014), Advanced. Strength and Applied. Stress Analysis. NY: McGraw-Hill
2. Saeed. M,(2008), Finite Element Analysis – Theory and Applications with ANSYS. NJ: Prentice Hall.

Suggested Readings

1. Saeed. M,(2008). *Finite Element Analysis – Theory and Applications with ANSYS.* NJ: Prentice Hall.
2. Fagan M J,(2010). *Finite Element Analysis – Theory and Practice.* NY: Pearson

GS-401 **Project Management** **2(2+0)**

Project management is the practice of leading the work of a team to achieve goals and meet success criteria at a specified. time. The primary challenge of project management is to achieve all of the project goals within the given constraints. This information is usually described. in project documentation, created. at the beginning of the development process. The primary constraints are scope, time, quality and budget, The secondary challenge is to optimize the allocation of necessary inputs and apply them to meet pre-defined. objectives. The objective of project management is to produce a complete project which complies with the client's objectives. In many cases the objective of project management is also to shape or reform the client's brief to feasibly address the client's objectives. Once the client's objectives are clearly established. they should influence all decisions made by other people involved. in the project – for example project managers, designers, contractors and sub-contractors. Ill-defined. or too tightly prescribed. project management objectives are detrimental to decision making.

Contents

1. Fundamental principles of Project Management, Project Proposals and feasibilities
2. Project Life Cycle and Product Life Cycles
3. Project organization and human resource management
4. Project management planning and work breakdown structure
5. Estimating time and cost of the project
6. Project sched.uling and control technique
7. Project risk analysis
8. Time compression and resource levelling
9. Software related. to Project Management

Recommended Texts

1. PMI. (2011) *Project Management Body of Knowled.ge* (PMBOK) (4^{th} ed.). US: Project Management Institute
2. Harold K, Kohn W. (2010), *Project Management: A Systems Approaching to Planning, Sched.uling, and Controlling.* NY: John Wiley & Sons.

Suggested Readings

1. Gregory H. (2011), *Project Management Beginner Guide*. US: Que Publishing
2. Harold K, (2012), *Project Management Approach to Planning.* NY: John Wiley & Sons.

MS-425 **Entrepreneurship** **1(1+0)**

Entrepreneurship can broadly be defined. as the creation or extraction of value. With this definition, entrepreneurship is viewed. as change, which may include other values than simply economic ones. Some more narrow definitions have described. entrepreneurship as the process of designing, launching and running a new business, which is often initially a small business, or as the "capacity and willingness to develop, organize and manage a business venture along with any of its risks to make a profit." The people who create these businesses are often referred. to as entrepreneurs. While definitions of entrepreneurship typically focus on the launching and running of businesses, due to the high risks involved. in launching a start-up, a significant proportion of start-up businesses have to close due to "lack of funding, bad business decisions, an economic crisis, lack of market demand, or a combination of all of these. A somewhat broader definition of the term is sometimes used., especially in the field of economics. In this usage, an entrepreneur is an entity which has the ability to find and act upon opportunities to translate inventions or technologies into products and services: "The entrepreneur is able to recognize the commercial potential of the invention and organize the capital, talent, and other resources that turn an invention into a commercially viable innovation.

Contents

1. Evolution of the concept of entrepreneur, Characteristics of an entrepreneur, Distinction between an entrepreneur and a Manager, Economic Development, Factors affecting entrepreneurial growth (economic, Non-Economic and Government factors)
2. Critical factors for stalling a new enterprise. Ingred.ients for a successful new business. Self-assessment and feed.back, Personal entrepreneurial competencies. Goal setting.
3. Creativity and sources of new business ideas, the difference between ideas and opportunity and creativity. Assessing business opportunities in Pakistan. Screening and evaluating opportunities Product planning and development process. Creating parallel competition by developing a similar product or service, Product life cycle, finding sponsorship. Acquiring a going concern, E-Commerce and business start-up and growth.
4. Marketing as a philosophy, marketing management: Creating a marketing plan, Analyze the environmental situation and the market opportunity, Setting marketing objective, formulating a marketing strategy.
5. The business plan as selling document, reasons for writing a business plan your company: What's your identity, Field work started., Marketing issues: Who are your buyers? Product issues: What are you selling? Production exercise, Sales and Promotion: Financial issues: Targeting and writing the plan: Business Plan compilation exercise.
6. What is franchising? Becoming a franchisee versus starting a standalone business, The franchisee contract, Non contractual, considerations of buying a franchise, Limitations of franchising, Conclusion, Course evaluation

Recommended Texts

1. Rober D. Hisrich and Michael P. P,(2010), *Entrepreneurship/lip*, (5th ed.). NY: McGraw Hill
2. Khanka S.S.(2009), *Entrepreneurial Development.* India: Chand Publisher

Suggested Readings

1. Bruce A. Kirchhoff, (2006), *Entrepreneurship and Dynamic Capitalism.* US: Praeger

ME-403 **Power Plants** **3 (3+0)**

A power plant is an industrial facility that generates electricity from primary energy. Most power plants use one or more generators that convert mechanical energy into electrical energy. The primary purpose of this course is to provide students with a broad understanding of electricity generation process and equipment. The course has been divided. into three parts, conventional and non-conventional power plants and their economics and management. Specific objectives of this subject are to gain understanding of working principles of various types of power plants operating on conventional as well as renewable energies and to learn the methods of trouble shooting, maintenance and optimization of various types of power plants. After studying this subject, student will be able to analyze strengths and weaknesses of different types of power plants by performing its thermodynamic calculations and through specific software's. The engineering aspect of power plant management has evolved. with technology and has become progressively more complicated. The introduction of nuclear technology and the progression of other existing technologies have allowed. power to be created. in more ways and on a larger scale than was previously possible.

Contents

1. Review of basic thermodynamics
2. Steam Generators and Turbines
3. Steam Power Plants
4. Gas Turbine Power Plants
5. Combined. Cycle Power Plants
6. Cogeneration
7. Diesel Engine Power Plant
8. Nuclear Power Plant
9. Renewable Energy Power Plants
10. Power Plant Economics and Management

Recommended Texts

1. Wakil, M. El. (2013). *Power Plant Technology*. New York: McGraw-Hill.
2. Cengel, Yunus A. Boles, M.A. (2019). *Thermodynamics: An Engineering Approach* (9th ed.). New York: McGraw-Hill.

Suggested Readings

1. Nag, P. K. (2014). *Power Plants Engineering*. New Delhi: Tata McGraw-Hill.
2. Woodruf, E. Lammers,H. Lammrers, T (2020). *Steam Plant Operation* (10th ed.). New York: McGraw-Hill.

ME-427 **IC Engine & Power Plant** **1(0+1)**

A power plant is an industrial facility that generates electricity from primary energy. Most power plants use one or more generators that convert mechanical energy into electrical energy. The primary purpose of this course is to provide students with a broad understanding of electricity generation process and equipment. An internal combustion engine (ICE) is a heat engine in which the combustion of a fuel occurs with an oxidizer (usually air) in a combustion chamber that is an integral part of the working fluid flow circuit. In an internal combustion engine, the expansion of the high-temperature and high-pressure gases produced. by combustion applies direct force to some component of the engine. The force is applied. typically to pistons, turbine blades, rotor or a nozzle. This force moves the component over a distance, transforming chemical energy into useful work. The engineering aspect of power plant management has evolved. with technology and has become progressively more complicated. The introduction of nuclear technology and the progression of other existing technologies have allowed. power to be created. in more ways and on a larger scale than was previously possible.

Contents

1. Experiments related. to the I.C Engines and Power Plants will be covered.
2. Teaching Methodology, Demonstration , Lab Report Writing
3. Assessment, Lab performance, Quizzes, Lab Report, Lab Exams, Lab Assignments

Recommended Texts

1. Wakil, M. El. (2013). *Power Plant Technology*. New York: McGraw-Hill.
2. Cengel, Yunus A. Boles, M.A. (2019).*Thermodynamics: An Engineering Approach* (9th ed.). New York: McGraw-Hill.

Suggested Readings

1. Nag, P. K. (2014). *Power Plants Engineering*. New Delhi: Tata McGraw-Hill.
2. Woodruf, E. Lammers,H. Lammrers, T (2020). *Steam Plant Operation* (10^{th} ed.). New York: McGraw-Hill.

SOC-329 **Social Science (Elective)** **2 (2+0)**

This course introduces contemporary and controversial ethical issues facing the business community. Topics include moral reasoning, moral dilemmas, law and morality, equity, justice and fairness, ethical standards, and moral development. Upon completion, students should be able to demonstrate an understanding of their moral responsibilities and obligations as members of the workforce and society. At the completion of the course requirements, the student will be able to define business ethics ,describe the evolution of business ethics ,describe major ethical perspectives ,understand and apply n ethical decision-making framework ,understand social responsibility from several dimensions ,understand how the organization influences ethical decision-making ,examine how significant others influence ethical decision-making ,develop an effective ethics programmer. And understand international business ethics. Positivist social scientists use methods resembling those of the natural sciences as tools for understanding society, and so define science in its stricter modern sense. Interpretivist social scientists, by contrast, may use social critique or symbolic interpretation rather than constructing empirically falsifiable theories, and thus treat science in its broader sense.

Contents

1. An Overview of Business Ethics: Business Ethics Defined., Social Responsibility, and Business Ethics, The Development of Business Ethics, Why study Business Ethics? Framework for Studying Business Ethics.
2. Ethical issues in Business: Foundation of Ethical Conflict, Classifications of Ethical, Issues, Ethical Issues Related. to Participants and Functional Areas of Business, Recognizing an Ethical Issue.
3. Applying Moral Philosophies to Business Ethics: Moral Philosophy Defined., Moral Philosophy Perspectives.
4. Social Responsibility: The Economic Dimension, The legal Dimension, The Ethical Dimension, the Philanthropic Dimension.
5. An Ethical Decision-Making Framework: Ethical Issue Intensity, Individual Factors: Stages of Cognitive Moral Development, Corporate Culture, Significant others, Opportunity, Business Ethics Evaluations and Intentions, Using the Ethical Decision-Making Framework to Improve Ethical Decisions.
6. How the Organization Influences Ethical Decision Making: Organizational Structure and Business Ethics, the role of Corporate Culture in Ethical Decision-Making, Group Dimensions of Organizational Structure and Culture, Implications of Organizational Relationships for Ethical Decisions.
7. The Role of Opportunity and Conflict: Opportunity, Conflict
8. Development of an Effective Ethics Programme: An Effective Ethical Compliance, Programme, Codes of Ethics and Compliance Standards, High-Level Manager's Responsibility for Ethical Compliance Programme and the Delegation of Authority, Effective Communication of Ethical Standards, Establishing Systems to Monitor, Audit, and Enforce Ethical Standards, Continuous Improvement of the Ethical Compliance Programme, The Influence of Personal Values in Business Ethics Programmes, The Ethical Compliance Audit.
9. International Business Ethics: Ethical Perceptions and International Business, Culture As a Factor in Business, Adapting Ethical Systems to a Global Framework: Cultural Relativism, the Multinational Corporation, A universal Set of Ethics, Ethical Issues Around the Globe.

Recommended Texts

1. Ferrell, O. C., and Fraed.rich, J. (2010), Ethical Decision Making and Cases. New York: Houghton Mifflin
2. Noe, R., Hollenbeck, J. Gerhart, B., & Wright, P. (2006), Human Resource Management (5th ed.). NY: McGraw-Hill

Suggested Readings

1. Newstrom John W. (2007), *Organizational Behavior* (12th ed.). NY: McGraw Hill.
2. Luthan Fred., (2005), *Organizational Behavior* NY: McGraw-Hill Inc.

ISL-316 **Islamic Studies** **2 (2+0)**

This course is aimed. to provide Basic information about Islamic Studies and to enhance understanding of the students regarding Islamic Civilization and to improve Students skill to perform prayers and other worships and to enhance the skill of the students for understanding of issues related. to faith and religious life**.** A subset of the Islamic sciences are *`Ulum ul-Qur'an*, (the sciences of the Quran), which include "how, where and when the Quran was revealed.", and its transformation from an oral tradition to the written form, etc. and *Ilm ul-Tajwid* (proper recitation), *Ilm ul-Tafsir* (exegesis of the Quran). (In this context "science" is the translation of the Arabic term for "knowled.ge, learning, lore," etc., rather than "science" or natural science as commonly defined. in English and other languages i.e., the use of observation, testable explanations to build and organize knowled.ge and pred.ictions about the natural world/universe' and is not to be confused. with the scientific work of Muslims such as Avicenna or Nasir al-Din al-Tusi.

Contents

1. Introduction to quranic studies ,Basic Concepts of Quran , History of Quran and Uloom-ul -Quran
2. Study of sellected. text of holly quran , Verses of Surah Al-Baqra Related. to Faith (Verse No. 284-286) ,Verses of Surah Al-Hujrat Related. to Adab Al-Nabi (Verse No-1-18) ,Verses of Surah Al-Mumanoon Related. to Characteristics of faithful (Verse No-1-11) ,Verses of Surah al-Furqan Related. to Social Ethics (Verse No. 63-77) , Verses of Surah Al-Inam Related. to Ihkam (Verse No. 152-154) , Study of sellected. text of holly quran ,Verses of Surah Al-Ihzab Related. to Adab al-Nabi (Verse No. 6, 21, 40, 56, 57, 58.) Verses of Surah Al-Hashar (Verse No. 18,19, 20) Related. to thinking, Day of Judgment ,Verses of Surah Al-Saf Related. to Tafakar,Tadabar (Verse No.1,14)
3. SEERAT OF HOLY PROPHET (S.A.W) I, Life of Muhammad Bin Abdullah (Before Prophet Hood) , Life of Holy Prophet (S.A.W) in Makkah Important Lessons derived. from the life of Holy Prophet in Makkah
4. SEERAT OF HOLY PROPHET (S.A.W) II , Life of Holy Prophet (S.A.W) in Madina , Important Events of Life Holy Prophet in Madina , Important Lessons derived. from the life of Holy Prophet in Madina.,Introduction to sunnah ,Basic Concepts of Hadith ,History of Hadith , Kinds of Hadith , Uloom –ul-Hadith ,Sunnah & Hadith ,Legal Position of Sunnah. Sellected. study from text of hadith introduction to islamic law and jurisprudence ,Basic Concepts of Islamic Law & Jurisprudence , History & Importance of Islamic Law & Jurisprudence , Sources of Islamic Law & Jurisprudence ,Nature of Differences in Islamic Law , Islam and Sectarianism
5. Islamic culture & civilization ,Basic Concepts of Islamic Culture & Civilization , Historical Development of Islamic Culture & Civilization , Characteristics of Islamic Culture & Civilization , Islamic Culture & Civilization and Contemporary Issues.
6. Islam & science , Basic Concepts of Islam & Science , Contributions of Muslims in the Development of Science , Quran & Science. Islamic economic system ,Basic Concepts of Islamic Economic System ,Means of Distribution of wealth in Islamic Economics , Islamic Concept of Riba , Islamic Ways of Trade & Commerce.,Political system of islam , Basic Concepts of Islamic Political System , Islamic Concept of Sovereignty , Basic Institutions of Govt. in Islam. Islamic history , Period of Khlaft-e-Rashida Period of Ummayyads , Period of Abbasids. Social system of islam , Basic Concepts of Social System of Islam , Elements of Family , Ethical Values of Islam

Recommended Texts

1. Hameed. M, (2004) Emergence of Islam. IRI, Islamabad

Suggested Readings

1. Mir Waliullah, (1982) Muslim Jurisprudence and the Quranic Law of Crimes. New Delhi: Islamic Book Service

COURSE OUTLINE BRIEFS

DEPARTMENT OF ELECTRICAL ENGINEERING

SARGODHA UNIVERSITY
Pathway to Progress

FACULTY OF ENGINEERING AND TECHNOLOGY

OVERVIEW

Electrical Engineering is the application of scientific and mathematical principles to the design, manufacture, and control of machines, processes, and systems. In the past, the work of electrical engineers has had a direct impact on society. For example, electrical engineers have been responsible for the creation of electric power, modern electronics, computers electronic communication systems, automated manufacturing and medical diagnostic tools. So electrical engineering experts are essential for rapid industrialization.

The Department of Electrical Engineering addresses the development of experts in the field of electrical engineering by offering a course leading to award of a Master of Science degree in Electrical Engineering. The Department offers graduate programs which culminate in BSc and MS degrees in Electrical Engineering. These programs are designed to provide a learning centered environment where qualified faculty shares their experience and knowledge with students so that graduate of the program can demonstrate a strong technical knowledge in their field so that they can lead and direct engineering and scientific industry teams in their chosen field of study.

Our faculty is experienced and knowledgeable in many of the electrical engineering disciplines, including communications, control system, Nano electronics, power systems, signal processing and solid state devices and they are working hard to train students for a rewarding career in electrical engineering which offers variety, challenge and stimulation. The mission of the department is to provide high quality education in the field of Electrical Engineering and prepare graduates for ongoing global challenges in industry, economy and research through their technical and entrepreneurial skills.

Mission Statement - Department of Electrical Engineering
The mission of the department is to provide high quality education in the field of Electrical Engineering and prepare graduates for ongoing global challenges in industry, economy and research through their technical and entrepreneurial skills.

Program Educational Objectives (PEOs):

PEO 1: Competent in Electrical Engineering discipline to meet organizational and industrial needs.

PEO 2: Professionally sound in project management and exhibit good leadership and entrepreneurial skills.

PEO 3: Understand the importance of lifelong learning and ethics towards the society.

BSc Electrical Engineering

Eligibility: At least 60% marks in FSc. (Pre-Engineering) or equivalent
Merit Determination: 70% Weightage of FSc. marks and 30% weightage of UET Entry Test

Duration: 4 Years
Semesters: 8
Degree Requirements: Minimum 130 credit hours

Semester -1

Course Code	Course	Credit Hours	Contact Hours
EE-111	Engineering Drawing	1(0+1)	3
ME-112	Workshop Practice	1(0+1)	3
EE-113	Applied. Physics	4(3+1)	6
CE-114	Introduction to Computing	2(1+1)	4
MATH-115	Calculus and Analytical Geometry	3(3+0)	3
ISL-116	Islamic Studies	2(2+0)	2
ENG-117	Functional English	3(3+0)	3

Semester-2

Course Code	Course	Credit Hours	Contact Hours
CE-121	Programming Fundamentals	3(2+1)	5
EE-122	Linear Circuit Analysis	4(3+1)	6
PK. ST-123	Pak Studies	2(2+0)	2
MATH-124	Linear Algebra & Differential Equations	3(3+0)	3
ENG-125	Communication Skills	3(3+0)	3
ME-126	Basic Mechanical Engineering	4(3+1)	6

Semester-3

Course Code	Course	Credit Hours	Contact Hours
EE-211	Digital Logic Design	4(3+1)	6
EE-212	Electrical Machines	4(3+1)	6
EE-213	Electronic Devices and Circuits	4(3+1)	6
MATH-214	Complex Variables and Transforms	3(3+0)	3
ENG-215	Technical Report Writing	3(3+0)	3

Semester-4

Course Code	Course	Credit Hours	Contact Hours
EE-221	Instrumentation and Measurements	4(3+1)	6
EE-222	Electronic Circuit Design	4(3+1)	6
STAT-223	Engineering Probability and Statistics	3(3+0)	3
ME-224	Applied. Thermodynamics	3(3+0)	3
EE-225	Electrical Network Analysis	4(3+1)	6

Semester-5

Course Code	Course	Credit Hours	Contact Hours
EE-311	Signals and Systems	4(3+1)	6
EE-312	Electromagnetic Field Theory	3(3+0)	3
EE-313	Microprocessor Systems	4(3+1)	6
MATH-314	Numerical Analysis	3(3+0)	3
CE-315	Data Structures & Algorithms	4(3+1)	6

Semester-6

Course Code	Course	Credit Hours	Contact Hours
EE-321	Linear Control Systems	4(3+1)	6
SOC-322	Social Sciences-I	3(3+0)	3
EE-323	Communication Systems	4(3+1)	6
ECON-324	Engineering Economics and Management	3(3+0)	3
EE-325	Elective-I	4(3+1)	6

Semester-7

Course Code	Course	Credit Hours	Contact Hours
EE-411	Design Project	3(0+3)	9
SOC-412	Social Sciences-II	2(2+0)	2
MS-413	Entrepreneurship	2(2+0)	2
EE-414	Elective-II	3(3+0)	3
EE-415	Elective-III	4(3+1)	6
EE-416	Elective-IV	4(3+1)	6

Semester-8

Course Code	Course	Credit Hours	Contact Hours
EE-421	Senior Design Project	3(0+3)	9
EE-422	Elective-V	4(3+1)	6
EE-423	Elective-VI	4(3+1)	6

BSc
ELECTRICAL ENGINEERING

EE-111 **Engineering Drawing (Lab)** **1(0+1)**

This lab is design to equip the student with hands-on of knowled.ge Engineering design with a special focus on electrical drawing. Electrical drawing is a type of technical drawing that shows information about power, lighting, and communication for an engineering or architectural project. This course will expose the students with the practical maneuvers as well as the basic knowled.ge/ skills of engineering drawing and its application in practical scenario. The students will also be introduced. to CAD package.

Contents

1. Types of lines lettering
2. Electrical devices symbols Bus Bar
3. Sectionalized. Bus Bar
4. Electrical power distribution system block diagram
5. Hydel power plant block diagram
6. Nuclear power plant block diagram
7. Thermal power plant block diagram
8. Isometric view 1 (Front, Top and Side)
9. Isometric view 2 (Front, Top and Side)
10. Isometric view 3 (Front, Top and Side)
11. Isometric view 4 (Front, Top and Side)

Recommended Texts

1. Siddiqi, Z. A. (2016). *Basics of Engineering Drawing.* Lahore: M/S Technical Publishers.

Suggested Readings

1. Horchsel, R. P. (2002). *Engineering Drawing and Geometry*. Hoboken: John Willy & Sons.

ME-112 **Workshop Practice (Lab)** **1 (0+1)**

Workshop practice gives the basic working knowled.ge required. for the production of various engineering products. It explains the construction, function, use and application of different working tools, equipment, machines as well as the technique of manufacturing a product from its raw material. This course helps students to achieve the practical experience and this ultimately polishes the capabilities, skills and concepts of students.' Workshop practice' as the name suggests provides students with an opportunity to experience different machining processes themselves along with the practical knowled.ge implementation and usage of tools from as basic as screw gauge to as complicated. and intricate as CNC.

Contents

1. Introduction to various technical facilities in the workshop including mechanical and electrical equipment.
2. Concepts in electrical safety, safety regulations, earthing concepts, electric shocks and treatment.
3. Use of tools used. by electricians, wiring regulations
4. Types of cables and electric accessories including switches, plugs, circuit breakers, fuses etc.
5. Symbols for electrical wiring schematics e.g. switches, lamps, sockets etc.,
6. Drawing and practice in simple house wring and testing methods
7. Wiring schemes of two-way and three-way circuits and ringing circuits
8. Voltage and current measurements.
9. Electric soldering and soldering tools; soldering methods and skills
10. PCB designing, transferring a circuit to PCB, etching, drilling and soldering component on PCB testing.
11. Machining processes.
12. Detailed. study of lathe, milling, CNC machines, grinders and cutters.
13. Types of joints
14. Metallic and wooden specimen practical operations.

Recommended Texts

1. Choudhury. (2010). *Elements of Workshop Technology* (13th ed.). Calcutta: Indian Book Distributing Company.
2. Chapman. (1972). *Workshop Technology* (5th ed.). London: Ed.ward Arnold

Suggested Readings

1. Choudhury. (2010). *Elements of Workshop Technology* (13th ed.). Calcutta: Indian Book Distributing Company.
2. Chapman. (1972). *Workshop Technology* (5th ed.). London: Ed.ward Arnold

EE-113 **Applied. Physics** **4 (3+1)**

This freshman level course has been designed. to provide an introduction to the ideas and concepts of Physics that would serve as a foundation for subsequent electronic engineering courses. The primary objective is to endow the knowled.ge of a wide variety of electric and magnetic phenomena along with their scientific applications, specifically, in the field of electronic engineering. The course initiates with a short review of relevant mathematics, immed.iately followed. by the basics of electricity at the atomic level. A majority of the course is then ded.icated. for electric and magnetic fields, forces, elements and their applications. Additionally, it also aims to provide introductory knowled.ge of wave theory, thermodynamics and semiconductor theory in conjunction with their applications.

Contents

1. Measurement, motion along a straight line.
2. Vectors and their components, laws of Physics.
3. Motion in two and three dimensions.
4. Force, motion, kinetic energy and work.
5. Potential energy, conservation of energy, center of mass, linear momentum and rotation.
6. Rolling, torque, angular momentum and gravitation.
7. Oscillations and Waves.
8. Temperature, heat and laws of thermodynamics.
9. Coulomb’s law and electric field.
10. Gauss’s law and electric potential.
11. Capacitance and energy stored. in an electric field.
12. Magnetic field, magnetic field due to current and Ampere’s law.
13. Induction, Faraday’s Law, Lenz’s Law and energy stored. in a magnetic field.
14. Current, resistance and Ohm’s law.
15. Single-loop circuits, Multi-loop circuits, work, energy and EMF.
16. Kirchhoff's voltage law, Kirchhoff's current law, voltage divider rule and current divider rule.

Recommended Texts

1. Sonntang, B, and Van W. (2012). *Fundamentals of Thermodynamics*. NY: John Wiley & Sons.
2. Halliday, D., Resnick, R., & Walker, J. (2018). *Fundamentals of Physics: Extended. (*11th ed.*)*. New York: Wiley.

Suggested Readings

1. Young, H. D., & Freed.man, R. A. (2015). *University Physics with Modern Physics* (14th ed.). United. Kingdom: Pearson.
2. Lorrain. P., Corson, D. R., & Lorrain, F. (2000). *Fundamentals of Electromagnetic Phenomena* (1st ed.). United. States: W. H. Freeman.

EE-113 Applied. Physics (Lab) 1 (0+1)

This freshman level course, using laboratory practice has been designed. to provide an introduction to the ideas and concepts of physics that would serve as a foundation for subsequent electrical and electronic engineering courses. The primary objective is to provide the knowled.ge of a wide variety of electric and magnetic phenomena along with their scientific applications, specifically, in the field of electrical and electronic engineering. The course initiates with the lab experiments related. to the basic mechanics, immed.iately followed. by the fundamentals of electricity and magnetism at the atomic level. A majority of the lab experiments are then ded.icated. for electric circuits, elements and their applications. Additionally, it also aims to provide introductory lab practical's of semiconductor theory in conjunction with their applications.

Contents

1. The Simple Pendulum.
2. Center of Gravity
3. Drawing Magnetic Curves
4. Reed. Relay and Solid-State Relay
5. Faraday Laws and Lenz's Law
6. Self-induction and Mutual Induction
7. Right Hand Grip Rule
8. Color Coding of Resistors
9. OHM's Law
10. Series and Parallel Combination of Resistors
11. Diode Characteristics
12. Half Wave Rectifier

Recommended Texts

1. Course Lab Manual
2. Halliday, D., Resnick, R., & Walker, J. (2018). *Fundamentals of Physics: Extended. (*11th ed.*)*. New York: Wiley.

Suggested Readings

1. Young, H. D., & Freed.man, R. A. (2015). *University Physics with Modern Physics* (14th ed.). United. Kingdom: Pearson.
2. Lorrain. P., Corson, D. R., & Lorrain, F. (2000). *Fundamentals of Electromagnetic Phenomena* (1st ed.). United. States: W. H. Freeman.

CE-114 **Introduction to Computing** **2(1+1)**

The aim of this course is to understand the basic concept of computer terminology, Programming, and provides fundamental concepts for hardware & software. The students not only learn about relevant cutting-ed.ge technology trends, but they also gain better knowled.ge in general. This introductory course explains in straightforward terms, the importance of learning about computers system and other computing devices, the various types of devices and their components, the principles by which computers work, the practical applications of computers and related. technologies, the ways in which the world is being changed. by these technologies, and the associated. risks and other potential association of computers and related. technologies. After completion, of course, the students are expected. to be reasonably good at basic concepts in computer system & basic programming, whereas C++ will be the language to implement these concepts.

Contents

1. Introduction to computer system: digital and analog computers, characteristics of computer, history of computer, generations of computer
2. Classification of computer, the computer system, the input-process-output concept, components of computer hardware, application of computers
3. The computer system hardware: central processing unit (CPU), memory unit, instruction format
4. Instruction set, instruction cycle, microprocessor, interconnecting the units of a computer, performance of a computer, inside a computer cabinet.
5. Computer memory: memory representation & hierarchy, registers, cache & primary memory
6. Secondary memory, access types of storage devices, magnetic tape, magnetic disk, optical disk
7. I/O devices: input-output unit, input devices, human and source data entry devices
8. Output devices, hard copy devices, soft copy devices, i/o port, working of i/o system
9. Data representation: number system, conversion from decimal to binary, octal, hexadecimal
10. Operating system, objective, types & function of OS,
11. Introduction to Programming Languages their type and how to debug code (debugging).
12. Algorithm & Flow charts, Flowcharts of different problems
13. Introduction to C++ language, syntax, program structure, termination. Variables, constants
14. Input/output functions in C++ language, Assignment operator & headers files
15. Introduction of Decision statements in C++ language. Increment & Decrement operator.
16. Introduction of Loops in C++ language, Nested. Control Structures, Switch Multiple-Selection Statement, and Logical Operators.
17. Introduction of arrays in C++ language programming and arrays input/output example

Recommended Texts

1. P. J. Deitel, H. Deitel (2017). *C++ How to Program* (10th ed.). New Jersey: Pearson.
2. Morley, D., & Parker, C. S. (2014). *Understanding computers: Today and tomorrow, comprehensive* (16th ed.). Boston: Cengage Learning

Suggested Readings

1. Tucker, A. B., Bradley, W. J., Cupper, R. D., & Garnick, D. K. (1992). *Fundamentals of Computing* (2nd ed.). New York: McGraw-Hill.

CE-114 **Introduction to Computing (Lab)** **1 (0+1)**

This course, using laboratory practice, introduces students to basic computer concepts in hardware, software, networking, computer security, and other emerging technologies such as blogs, wiki and Google applications. Widely used. applications including word processing, spreadsheets, presentation, and MATLAB tools are studied. The purpose of the information technology requirement is to ensure that students achieve an essential understanding of information technology infrastructure encompassing systems and devices; learn to make the most of the widely used. packages and other network resources; take advantage of latest technologies; and become more sophisticated. technology users.

Contents

1. To Study Basic Computer Organization, Elements of Computer Systems Hardware & Software, Block Diagram of Computer, CPU Memory, I/O devices, Setting Up to PC.
2. Introduction to Word Processing, Package Installation, MS Word 2013, Creating a new word document, Opening, ed.iting, etc.
3. Formatting Page, margins, page size, portrait, using bullets, Using and manipulating tables, inserting deleting of rows and columns in Word Processing Application.
4. Sorting Tables, header, footer, page #, printing, shortcuts, Charts, Drawing and Modifying Charts.
5. Intro to Spreadsheet Application, Launching and Exploring Excel, entering data into Spreadsheet, Widen rows & Columns in Excel, Centering Data in a Cell, Font Formatting, and Saving Work.
6. Entering data into Cells, Basic Operators, adding up with sum, Multiplying and Avg. function in Spreadsheet application.
7. Conditional formatting, The CountIF, & SUMIF function, Excel Tables, Charts in spreadsheet application.
8. Decision Making using If, If-Else, Multiple Nested. If-Else statement in spreadsheet application.
9. Intro to PowerPoint 2013, Creating presentation, working with a presentation, Adding & Modifying Slides / texts, Applying & modifying templates.
10. Using color scheme, Drawing & Modifying objects, Images, Links, producing slideshow, creating a multimed.ia presentation.
11. Introduction to Matlab, Starting & ed.iting, Command Windows, History, workspace etc.
12. Solution of Simple Mathematical Problems using MATLAB.
13. Matrix Generation, Addition, Multiplication, Transpose Using MATLAB.
14. Intro to various OS (Linux, Fed.ora etc.).

Recommended Texts

1. *Course Lab Manual*
2. Norton P. (2006). *Introduction to Computers* (6th ed.). New Delhi: McGraw-Hill ed.ucation.

Suggested Readings

1. Vermaat, M. E., Sebok, S. L., Freund, S. M., Campbell, J. T., & Frydenberg, M. (2017). *Discovering Computers 2018: Digital Technology, Data, and Devices.* USA: Nelson Ed.ucation.

MATH-115 **Calculus and Analytical Geometry** **3 (3+0)**

The objective of the course is to enable the students to understand the principles of calculus and its application in solving engineering problems. Calculus is the mathematical study of continuous change. If quantities are continually changing, we need. calculus to study what is going on. Calculus is concerned. with comparing quantities which vary in a non-linear way. It is used. extensively in science & engineering, since many of the things we are studying (like velocity, acceleration, current in a circuit) do not behave in a simple, linear fashion. Calculus has two major branches, differential calculus (Calculus – I) & integral calculus (Calculus – II); the former concerns instantaneous rates of change, & the slopes of curves, while integral calculus concerns accumulation of quantities, & areas under or between curves.

Contents

1. Mathematical and physical meaning of functions
2. Graphs of various functions, Hyperbolic functions.
3. Theorems of limits and their applications to functions: Continuous and discontinuous functions, applications.
4. Introduction to derivatives:
5. Application problems (rate of change, marginal analysis)
6. Leibnitz theorem, Rolles theorem, Mean value theorem. Taylor's and Maclaurin's series
7. Indeterminate forms (0/0), (∞/∞). Asymptotes, tangents and normal, curvature and radius of curvature
8. Maxima and minima of a function for single-variable (applied. problems)
9. Differentials with applications. Euler's theorem, total differentials, maxima and minima of two variables.
10. Methods of integration by substitutions and by parts
11. Integration of rational and irrational algebraic functions
12. Definite integrals, improper integrals, Gamma and Beta functions, red.uction formulae.
13. Cost function from marginal cost, rocket flights, area under curve.

Recommended Texts

3. Schaum's series. (2012). *Calculus* (6th ed.). New York: VaSchaum's series.
4. Antom, H. (1995). *Calculus and Analytic Geometry* (10th ed.). Hoboken: John Wiley and Sons.

Suggested Readings

1. Talpur. (1972). *Calculus and Analytic Geometry* (1st ed.). Lahore: Feroz Sons.

ISL-116 **Islamic Studies** **2 (2+0)**

To provide Basic information about Islamic Studies. To enhance understanding of the students regarding Islamic Civilization. To improve Students skill to perform prayers and other worships. To enhance the skill of the students for understanding of issues related. to faith and religious life. Islamic Studies engages in the study of Islam as a textual tradition inscribed. in the fundamental sources of Islam; Qur'an and Hadith, history and particular cultural contexts. The area seeks to provide an introduction to and a specialization in Islam through a large variety of expressions (literary, poetic, social, and political) and through a variety of methods (literary criticism, hermeneutics, history, sociology, and anthropology). It offers opportunities to get fully introductory foundational bases of Islam in fields that include Qur'anic studies, Hadith and Seerah of Prophet Muhammad (PBUH), Islamic philosophy, and Islamic law, culture and theology through the textual study of Qur'an and Sunnah. Islamic Studies is the academic study of Islam and Islamic culture. It majorly comprises of the importance of life and that after death. It is one of the best systems of ed.ucation, which makes an ethical groomed. person with the qualities which he/she should have as a human being. The basic sources of the Islamic Studies are the Holy Qur'an and Sunnah or Hadith of the Holy Prophet Muhammadﷺ. The learning of the Qur'an and Sunnah guides the Muslims to live peacefully.

Contents

1. Introduction to Quranic studies
2. Study of selected. text from the Quran
3. Seerat of Prophet (SAW)
4. Introduction to Sunnah
5. Introduction to Islamic law & Jurisprudence
6. Islamic Culture & Civilization
7. Islam and Science
8. Islamic Economic System
9. Political System of Islam
10. Islamic History

Recommended Texts

4. Hassan, A. (1990). *Principles of Islamic jurisprudence*. New Dehli: Adam Publishers.
5. Zia-ul-Haq, M. (2001). *Introduction to al-Sharia al-Islamia*. Lahore: Aziz Publication.

Suggested Readings

4. Hameed.ullah, M. (1957). *Introduction to Islam.* Lahore: Sh M Ashraf Publisher.
5. Hameed.ullah, M. (1980). *Emergence of Islam.* New Dehli: Adam Publishers.
6. Hameed.ullah, M. (1942). *Muslim conduct of state.* Lahore: Sh M Ashraf Publisher.

ENG-117 **Functional English** **3 (3+0)**

The aim of this course is to lift student's understanding in English language so that they should be able to read, write and speak English with ease. This course especially focuses on the English Language skills of the Electrical Engineering students from an intermed.iate to advanced. level and encourage them to overcome their fear of public speech. It also helps the students to build their confidence and to groom their personality to communicate at executive level jobs. Special interest of the students is established. in the form of individual and group effort by giving them virtual and real-life trainings, presentations and projects which results in improved. team functioning and team output.

Contents

1. Parts of Speech.
2. Punctuation.
3. Phrases and Clauses.
4. Sentences.
5. Active & Passive Voice.
6. Direct & Indirect Narration.
7. Vocabulary Development/ Contextual Clues.
8. Tenses in English Grammar
9. Paragraph Writing
10. Three Basic Letter Formats
11. Listening Skills (Documentaries).
12. Reading & Comprehension
13. Urdu to English
14. Paragraph writing
15. Transitive and intransitive verbs.
16. Punctuation and spelling.
17. Analysis of phrase, clause, and sentence structure

Recommended Texts

1. A. J. Thomson and A. V. Martinet. (1997). *Practical English Grammar (3rd ed.)*. Oxford: Oxford University Press.
2. Marie-Christine Boutin, Suzanne Brinand and Francoise Grellet. (1993). *Writing. Intermed.iate* (4th Impression). Oxford: Oxford Supplementary Skills.

Suggested Readings

1 Brain Tomlinson and Rod Ellis. (1992). *Reading: Upper Intermed.iate*. Oxford: Oxford Supplementary Skills.

CE-121 Programming Fundamentals 4 (3+1)

The main aim of this course is to acquaint students with the fundamental concepts of structured. and object-oriented. computer programming language such as C++ whose lessons extend to any programming language. This course introduces the fundamental concepts of structured. programming and provides a comprehensive introduction to programming. Topics include data types, control structures, functions, classes, arrays and pointers. This course assumes computer literacy.

Contents

1. Programming Basics: C++ program structure, basic data types., input and output with "cin" and "cout"
2. Arithmetic, assignment, increment and decrement operators, relational operator
3. Loops: For loop, while loop
4. Do-while loop, nested. loops
5. Decision statements: if and if…. else statements, nested. if…. else statements
6. Switch statements, conditional operators, logical operators, continue statements, goto statements, variable Scope, global Variables
7. Structures: Structures Introduction, defining the structure, defining a structure variable, accessing structure members, structure within structures, enumerations
8. Functions: Function declaration and definition, calling a function, passing arguments to a function, return values, passing arguments by reference
9. Overloaded. function, default arguments, returning values by reference
10. Classes and Objects: Defining the class (Member functions and Data), defining objects, calling member functions, private vs public access specifiers
11. Constructors, overloaded. constructors, destructors, objects as function arguments, default copy constructor, returning objects from function
12. Arrays: Array definitions, accessing array elements, array as class members, array of objects
13. C-String, input/output String, copy String, standard C++ String class, finding, comparing, modifying string objects, accessing characters in string objects
14. Pointers: Addresses and Pointers, pointer variables, accessing the variable pointed. to
15. Pointers and arrays, pointers and functions, passing arrays to functions
16. Disk File I/O, reading data, writing data, closing the file

Recommended Texts

1. Robert Lafore. (2001). *Object-Oriented. Programming in C++* (4th ed.). New Jersey: Prentice Hall.

Suggested Readings

1. Deitel and Deitel. (2017). *C++, How to Program* (10th ed.). New Jersey: Prentice Hall.
2. Wu, C. T. (2006). *An Introduction to object-oriented. programming with Java TM*. New York: McGraw-Hill Incorporated.

CE-121 **Programming Fundamentals (Lab)** **1 (0+1)**

Computer Programming is an increasingly demanding skill, either one aspires to a career in the computer science field, or in other domains. This introductory course is the first step in programming, but its lessons extend to any computer language. Programming is fundamentally about figuring out how to solve a class of problems, designing algorithms, a clear set of steps to solve any problem in its class. This course will introduce you to a powerful problem-solving which you can use to solve any programming problem. The Main aim of this lab is to acquaint the students with the fundamental concepts of structured. and Object Oriented. Programming (OOP) computer programming language such as C+.

Contents

1. Introduction to C++, Syntax, Program Structure, Problem Solving
2. C++ Building Blocks, Pseudocode, Header files, Operators, Flow charts, Simple programs in
3. C++.
4. Control Structures, Decision Making using simple If, If-Else statements.
5. Multiple If-Else statements, Nested. Ifs, Logical Operators and flowcharts.
6. Decision Making with Switch structure and Comparison with If-else statement.
7. Looping Constructs, for loop, while Loop and do while Loop.
8. Looping Constructs do while Loop and Nested. loop.
9. 1-Dimensional and Multi-Dimensional Arrays in C++ Language.
10. Structures in C++ Language.
11. Pointers in C++ Language.
12. Functions in C++ Language.
13. Introduction to Object Oriented. Programming in C++.
14. Creating objects in OOP and Claas, Properties, Methods and Members.

Recommended Texts

1. *Course Lab Manual*
2. Robert Lafore. (2001). *Object-Oriented. Programming in C++* (4th ed.). New Jersey: Prentice Hall.

Suggested Readings

1. Deitel and Deitel. (2017). *C++, How to Program* (10th ed.). New Jersey: Prentice Hall.

EE-122 **Linear Circuit Analysis** **4 (3+1)**

Linear Circuit Analysis is the first course of the three-course sequence covering the Electric Circuits and Electronics stream. The course provides the undergraduate students with the foundation of basic laws, theory of linear electric circuits with passive elements and AC fundamentals. First portion of this course introduces basic concepts to be followed. with the description of current and voltage sources. An introduction to networks and circuits is accompanied. by detailed. discussion of basic laws, and delta-wye transformations. This is followed. by circuit analysis techniques using Nodal and Mesh Analysis, important theorems like source transformation, superposition, Thevenin's, Norton's, and maximum power transfer theorem. Second portion of this course introduces operational amplifiers, capacitance, inductance, and their series & parallel combination. First order RL, RC Circuits and second order RLC circuits are also taught to find the transient and steady state response of these kinds of circuits. Some Basic introduction of AC are also covered. in the third potion of this course.

Contents

1. Basic concepts: systems of units, voltage, current, power and energy, circuit elements, independent and dependent Sources
2. Basic laws: introduction, ohm's law, nodes, branches, and loops, kirchhoff's laws, series resisters and voltage division, parallel resistors, and current divisions
3. Wye-delta transformations, delta to wye conversion, wye to delta conversion
4. Methods of analysis: introduction, nodal analysis, nodal analysis with voltage source
5. Mesh analysis, mesh analysis with current source
6. Circuits theorems: introduction, linearity property, superposition theorems
7. Source transformation, thevenin's theorems
8. Norton's theorem
9. Maximum power transfer theorem
10. Operational amplifiers: ideal & non- ideal, inverter, voltage follower, summer, and difference amplifier.
11. Capacitors and inductors: capacitors, inductors, series & parallel capacitors, and inductors
12. First order circuits: introduction, the source-free RC Circuit, the source-free RL circuit
13. Step response of an RC circuit
14. Step response of an RL circuit
15. AC fundamentals: sinusoids, phasors with circuit Elements, imped.ance, and admittance
16. AC power analysis: introduction, instantaneous and average power, effective or RMS Value

Recommended Texts

1. Charles, K. A., & Matthew, N. O. (2017). *Fundamentals of electric circuits* (5th ed.). New York: McGraw-hill Ed.ucation.

Suggested Readings

1. Franco, S., Kang, J. S., Nahvi, R., & Soderstrand, M. (1995). *Electric circuits fundamentals* (Int. St. ed.). Florida: Saunders College Pub.
2. Thomas, R. E., Rosa, A. J., & Toussaint, G. J. (2016). *The analysis and design of linear circuits* (7th ed.). New jersey: John Wiley & Sons.

EE-122 **Linear Circuit Analysis (Lab)** **1 (0+1)**

This course, using laboratory practice, describes and illustrates fundamental theory and practical for the analysis of Direct Current (DC) and Alternating Current (AC) electrical circuits using different components and Lab equipment. This course provides the undergraduate students with the foundation of basic laws, theory of linear electric circuits with passive elements and AC fundamentals and understanding the Phasors diagram and Phase difference. The laboratory emphasizes the practical, hands-on component of this course. It complements the theoretical material presented. in lecture, and as such, is integral and indispensable to the mastery of the subject. There are several items of importance here including proper safety proced.ures, required. tools, and laboratory reports. This exercise will finish with an examination of scientific and engineering notation, the standard form of representing and manipulating values.

Contents

1. Introduction to laboratory equipment.
2. Resistance color code and measurement of resistance.
3. Resistors in series and parallel.
4. Ohm’s law, Kirchhoff’s voltage and current laws.
5. Analyze and implement nodal analysis.
6. Analyze and implement mesh analysis.
7. Analyze and implement Thevenin's theorem.
8. Analyze and implement Norton’s theorem.
9. Analyze and implement superposition theorem.
10. Analyze and implement maximum power transfer theorem.
11. Analyze and implement RL & RC series circuit.
12. Analyze and implement RLC series circuit.
13. Inverting and non-inverting behaviors of amplifiers.
14. Design project.

Recommended Texts:

1. *Course Lab Manual*.
2. Sadiku, M. N., & Alexander, C. K. (2020). *Fundamentals of electric circuits* (7th ed.). New York: McGraw-Hill.

Suggested Readings

1. Franco, S., Kang, J. S., Nahvi, R., & Soderstrand, M. (1995). *Electric circuits fundamentals* (Int. St. ed.). Florida: Saunders College Pub.

PK. ST-123 **Pakistan Studies** **2 (2+0)**

Pakistan Studies was introduced. in the national curriculum as a compulsory subject in 1972 by the government of Zulfiqar Ali Bhutto. This course inculcates among the students a better understanding of Pakistan and its influence on the evolution and progress of the society, so that they may acquire proper perspective of thoughts and actions taken in the past. This aims to introduce students to the history of the region comprising Pakistan, providing an overview of contending perspectives on the origins of the Country, religion and examine its politics, society and culture. This approach will furnish the upcoming generations with knowled.ge and skills to promote a sense of patriotism, awareness of the State, culture, society and to develop universal human values in the society and about the world. Students will be able to synthesize information from a variety of sources to describe the political situation of Pakistan, investigate and lead a discussion on key contemporary issues, describe and analyse the current situation of Pakistan, debate future plans for development in Pakistan, leadership qualities would be imparted. in the personalities of the students. The course, furthermore, looks at some contemporary developmental issues facing the Country. "We are not makers of history. We are made by history".

Contents

1. Introduction to the Course
2. Geography of Pakistan: Geo-Strategic Importance of Pakistan
3. Freed.om Movement and Pakistan Movement
4. Nationalism in South Asia and Two Nations Theory
5. Ideology of Pakistan
6. Initial Problems of Pakistan
7. Political and Constitutional Developments in Pakistan
8. Economy of Pakistan
9. Society and Culture of Pakistan
10. Foreign Policy Objectives of Pakistan and Diplomatic Relations
11. Current and Contemporary Issues of Pakistan
12. Human Rights: Issues of Human Rights in Pakistan.

Recommended Texts

8. Kazmi, M.R. (2018). *Pakistan Studies.* Oxford: Oxford University Press.

9. Qureshi, I.H. (1957). *The struggle for Pakistan*. Karachi: The Board of ed.itors.

Suggested Readings

10. Ikram Rabbani, M. (2005). *A comprehensive book of Pakistan studies*. Lahore: The Caravan Book House.

11. Chawla, M. I. (2017). One belt one road summit 2017 and its implications for CPEC: an overview. South Asian Studies, 32(2), 277-284.

12. Burke, S. and Ziring, L. (1994). *Pakistan's foreign policy*. Karachi: Oxford University Press.

MATH-124 **Linear Algebra** **3 (3+0)**

This is an undergraduate course in linear algebra for students of engineering. Linear algebra is the study of linear systems of equations, vector spaces, and linear transformations. Solving systems of linear equations is a basic tool of many mathematical proced.ures used. for solving problems in science and engineering. In this class we will concentrate on the mathematical theory and methods of linear algebra. The student will become competent in solving linear equations, performing matrix algebra, calculating determinants, and finding eigenvalues and eigenvectors. On the theoretical side, the student will come to understand a matrix as a linear transformation relative to a basis of a vector space. The student will understand the concept of orthogonality of vectors. The engineering and science student will have a solid base of understanding in elementary linear algebra as required. for further undergraduate work in those fields and the mathematics student will be prepared. for a more formal linear algebra course.

Contents

1. System of Linear Equations and Matrices, introduction to system of linear equations
2. Matrix form of system of Linear Equations, Gaussian Elimination method
3. Gauss-Jorden Method, consistent and inconsistent systems
4. Homogeneous system of equations, vector equations, introduction to vector in plane
5. Vector in RPn, vector form of straight line, linear combinations
6. Geometrical interpretation of solution of Homogeneous and Non-homogeneous equations
7. Applications of Linear Systems, traffic flow problem, electric circuit Problem
8. Economic Model Linear transformations, introduction to linear transformations
9. Matrix transformations, domain and range of linear transformations
10. Geometric interpretation of linear transformations
11. Matrix of linear transformations Inverse of a matrix, definition of inverse of a matrix
12. Algorithm to find the inverse of matrices, LU factorization determinants
13. Introduction to determinants, geometric meaning of determinants
14. Properties of determinants, Crammer Rule
15. Cofactor method for finding the inverse of a matrix Vector Spaces
16. Vector spaces, subspaces, spanning set, null spaces
17. Linearly Independent sets and basis, bases for Null space and Kernal space
18. Dimension of a vector space Eigen Values and Eigen vectors
19. Eigen values: Properties and applications, eigen vectors, diagonalization

Recommended Texts

1. Lay, D. C. (2012). *Linear Algebra and Its Application* (4th ed.). Boston: Addison-Wesley.
2. Anton H., Rorres C. (2014). *Elementary Linear Algebra: Applications Version* (11th ed.). USA: John Wiley & Sons.

Suggested Readings

1. Strang, G. (2006). *Linear Algebra and Its Applications* (4th ed.). Boston: Cengage Learning.
2. Cherney, D., Denton, T., Thomas, R., Waldron, A. (2013). *Linear Algebra* (1st ed.). California: UC Davis

MATH-124 **Differential Equations** **3 (3+0)**

This course introduces the theory, solution, and application of ordinary differential equations. Topics discussed. in the course include methods of solving first-order differential equations, existence and uniqueness theorems, second-order linear equations, power series solutions, higher-order linear equations, systems of equations, non-linear equations, Sturm-Liouville theory, and applications. The relationship between differential equations and linear algebra is emphasized. in this course. An introduction to numerical solutions is also provided. Applications of differential equations in physics, engineering, biology, and economics are presented. The goal of this course is to provide the student with an understanding of the solutions and applications of ordinary differential equations. The course serves as an introduction to both nonlinear differential equations and provides a prerequisite for further study in those areas.

Contents

1. First order differential equations, variables separable forms,
2. Homogenous equations, non-homogenous equations,
3. Exact equations, linear equations,
4. Solution by substitutions Applications of First Order DE’s
5. Modeling with the first order differential equations
6. Orthogonal trajectories, population dynamics
7. Applications of linear equations
8. Applications of non-linear equations Higher Order Linear Differential Equations
9. Introduction and preliminary theory,
10. Initial-value and boundary-value problems,
11. Homogenous and non-homogenous equations,
12. Method of undetermined. coefficients,
13. Method of variation of parameters,
14. Power series solution Applications of the Second Order Differential Equations
15. Spring mass problems,
16. RLC Circuit Partial Differential Equations
17. Vibrating string, Wave equation,
18. Separation of variables,
19. Heat equation solution by separation of variables

Recommended Texts

1. Kreyszig, E. (2014). *Advanced. Engineering Mathematics* (10th ed.). USA: Wiley.
2. Zill, D.G., Michael, R. (2009). *Differential equations with boundary-value problems* (5th ed.). USA: Brooks/Cole.

Suggested Readings

1. Arnold, V. I. (1991). *Ordinary Differential Equations* (3rd ed.). New York: Springer.
2. Apostol, T. (1969). *Multi Variable Calculus and Linear Algebra* (2nd ed.). US: John Wiley & sons.
3. Boyce, W. E., Diprima, R. C. (2012). *Elementary differential equations and boundary value problems* (10th ed.). US: John Wiley & Sons.

ENG-125 **Communication Skills** **3 (3+0)**

This course enhances the written, verbal & non-verbal communication skills of the Electrical Engineering students from a mid-level to advance level. This course introduces the basic writing skills affiliated. to research, to help students in writing research papers for the contemporary Engineering courses. It also builds the confidence and groom the student's personality so that they can aim at executive level jobs. The prime focus of this course is to build the combination of language and interpersonal skills need.ed. to work with different organizations confidently, lead teams effectively, make plans workable, and result oriented. in their approach. Special interest of the students is established. in the form of individual and group effort by giving them virtual and real-life trainings, presentations and projects which results in improved. team functioning and team output for the benefit of their company. Consequently, this course helps students to become good and effective communicator within or outside the organization.

Contents

1. Seven Cs of Communication.
2. Business Writing Styles.
3. Business Memos.
4. Business Emails.
5. Tenders and Quotations.
6. Billing and Invoicing.
7. Common Writing Errors.
8. Useful Vocabulary and Phrases.
9. Personal Documents.
10. Verbal and non-verbal communication.
11. Conducting meetings.
12. Small group communication.
13. Taking minutes.
14. Presentation strategies.
15. Defining the objective, scope and audience of the presentation.
16. Material gathering and material organization strategies.
17. Time management
18. Opening and Concluding.
19. Use of audio-visual aids.
20. Delivery and presentation.

Recommended Texts

1. A. J. Thomson and A. V. Martinet (1997). *Practical English Grammar (*3rd ed.*)*. Oxford: Oxford University Press.
2. Marie-Christine Boutin, Suzanne Brinand and Francoise Grellet (1993). *Writing Intermed.iate* (4th Impression). Oxford: Oxford Supplementary Skills.

Suggested Readings

1. Khaled. Mohamed. Al Maskari. (2012). *A Practical Guide to Business Writing: Writing in English for Non-Native Speakers*. USA: Wiley.

ME-126 **Basic Mechanical Engineering** **4 (3+1)**

The course is intended. to give a thorough understanding of the basic mechanical engineering concepts. Furthermore, the students will be able to understand the fundamental concepts and principles of mechanics including law of equilibrium, application of dynamics to the engineering concepts, pulleys, chains, and free body diagrams.

Contents

1. Fundamental concepts and principles of mechanics
2. Fundamental units, moments and couples
3. Laws of equilibrium
4. Free body diagrams: structures, frames and machines.
5. Fundamentals of dynamics: Applications of Newton's second law of motion
6. Analysis of motion in two dimensional and three-dimensional spaces
7. Methods of energy and momentum,
8. Applications of dynamics to the engineering concepts, pulleys, chains
9. Design of flywheel, bearings
10. Mechanical power transmission

Recommended Texts

1. J. L. Merriam & L. G. Kraige. (2018). *Engineering Mechanics Dynamics*. USA: John & Wiley Sons.

Suggested Readings

1. J. L. Merriam & L. G. Kraige. (2018). Engineering Mechanics Dynamics. USA: John & Wiley Sons.

ME-126 **Basic Mechanical Engineering (Lab)** **1(0+1)**

Basic Mechanical engineering, as its name suggests, deals with the mechanics of operation of *mechanical* systems. This is the branch of engineering which includes design, analysis, testing and maintenance of *mechanical* systems. Within the practical sciences, the course is useful in formulating new ideas and theories, discovering and interpreting phenomena, and developing experimental and computational tools. The basic purpose of studying BMT is to develop the conceptual and practical skills regarding time, moment, forces, their actions, reactions as well as force systems and implement the theoretical knowled.ge into finding practically observed. and gathered. results.

Contents

1. Force, Types of Force, Effects of force on various mechanical and structure members, Moment of force, Equilibrium
2. Study of UTM
3. Tensile test on UTM
4. Simple stress
5. Shear stress, Hooke's law and its verification
6. Bearing stress
7. Young's modulus, Bulk modulus and their verification
8. Bending moment and shearing force Bending Stresses
9. Deflection of beams, Torsion of bars of circular cross section
10. Flywheel
11. Mechanical efficiency and power of gear train
12. Design of shafts, pulleys, bearings and couplings
13. Power transmission by belts, spur gears and friction clutches
14. Deflection of beams
15. Torsion of bars of circular cross section

Recommended Texts

1. Prof. Paul D. Ronney. (2016). *Basics of Mechanical Engineering*. California: USC.

Suggested Readings

1. Crustar Nieman. (1980). *Machine elements design and calculations in mechanical engineering.* Berlin: Springer.
2. F.P. Beer and Johnston. (2020). *Mechanics of Materials* (8^{th} ed.). USA: McGraw Hill Book Co.

EE-211 **Digital Logic Design** **4 (3+1)**

The aim of the course is to understand the design & analyzing the digital logic circuits & basic software tools for the design and implementation of digital circuits. The objectives of this course are to introduce the concept of digital and binary systems and further topics that include Number Systems, Boolean Algebra, Logic Simplification, Combinational Logic, Sequential Logic, Latches, Flip-Flops and their applications. Adders, Multiplexers, Counters, Shift Registers, and simple Arithmetic Logic Unit (ALU). Design and implementation of combinational circuits in Verilog, Introduction to FPGA and explain the state-of-the-art digital logic design. One of the main goals of this course is to ed.ucate students the key concepts in conventional digital design and to clearly demonstrate the way in which digital circuits are designed. and analyzed. these days.

Contents

1. Introduction, Number Systems, Digital System, Binary Numbers
2. Number base Conversions, (Decimal, Binary, Octal and Hexadecimal Numbers)
3. Compliments, Signed. Binary Number, Binary Codes, Gray Code, BCD System, Binary, Addition, Subtraction and Multiplication
4. Boolean Algebra, Axiomatic Definition of Boolean Algebra, Basic Theorems & Postulates
5. Boolean Function, Boolean laws and red.uction, Conical Standard From, Logic Gates.
6. Gate level Minimization, K-map (two variable, three variable and four variable)
7. Prime Implicants, Sum of Product (SOP), Product of Sum (POS) Simplification
8. K-map Methods, NAND & NOR implementation, Two level Implementations
9. Don't Care Condition and Introduction to HDL (Hardware Description Language).
10. Introduction to Combinational Logic Circuit, Analysis Proced.ure, Design Proced.ure of Combinational Logic Circuit. Combinational Logic Model using Verilog.
11. Binary Adder-Subtractors (Half Adder, Full Adder,) and 4 Bit parallel adder. Verilog HDL Implementation of Half Adder & Full Adder
12. Magnitude Comparator, Decoder, Encoder, Implementation of full adder with a decoder
13. Multiplexers and De-multiplexer, HDL Model of Combinational Circuit.
14. Synchronous Sequential Logic: Design and Analysis Proced.ure of Sequential circuits, Introduction sequential circuits, storage element: Latches, Flip-Flops,
15. State equations and state diagram. Analysis & design sequential circuits state red.uction Register & Counters: Registers, Shift Registers and Universal Shift Register)
16. Counters: Ripple Counters, BCD Ripple counters, Synchrony Counters and other counters.

Recommended Texts

1. M. Morris Mano and Micheal D. Ciletti. (2013). *Digital Design: an introduction to the Verilog HDL (*5th ed.). New Jersey*:* Prentice Hall.

Suggested Readings

1. Tocci and Widmer. (2011). *Digital Systems: Principles and Applications (11th ed.).* New Jersey: Prentice Hall.

EE-211 **Digital Logic Design (Lab)** **1 (0+1)**

This course, using laboratory practice, describes and illustrates fundamentals of Digital Logic Design, design and implementation of small-scale logic circuits (basic, combinational & sequential digital circuit) for desired. output. The aspirants will able to demonstrate the acquired. knowled.ge to apply techniques related. to the design and analysis of digital logic circuits

Contents:

1. To study basic logic gate integrated. circuits and verification of their truth tables.
2. Implementation of the universality of nand and nor gates.
3. Implementation of the half adder and full adder.
4. Implementation of the 4-bit parallel adder using ic 74283.
5. Implement of the half and full subtractor.
6. Implementation of the code converters using gates.
7. To implement the encoder and decoder using ic 74138 & 74148.
8. Implementation of multiplexer and demultiplexer using ic74151& ic74138.
9. Verification of latch and flip flop operation using gates and flip flop’s ic.
10. Implementation of 4-bit synchronous binary counter.
11. Implementation of series and parallel registers.
12. Tutorials – introduction to modalism and Verilog.
13. Semester project.

Recommended. Text

1. *Course Lab Manual*.
2. M. Morris Mano and Micheal D. Ciletti. (2013). *Digital Design with an introduction to the Verilog HDL* (5th ed.). New Jersey: Prentice Hall.
3. Morris Mano and Charles R. Kime. (1997). *Logic and Computer Design Fundamentals* (5th ed.). New Jersey: Prentice Hall.

Suggested. Readings

1. Tocci and Widmer. (2011). *Digital Systems: Principles and Applications* (11th ed.). New Jersey: Prentice Hall.

EE-212 **Electrical Machines** **4 (3+1)**

This course is intended. to provide a basic introduction to the theory of magnetic circuits linked. with transformers and rotating electrical machines. The principles of electromechanical energy conversion will be discussed. in the context of induction motors and DC machines. In depth analysis of DC & induction motors will be carried. out for different characteristics. Special-purpose fractional-horsepower motors will also be covered. in the course with introduction of brushless DC (BLDC) motors, stepper motors and switched. reluctance (SR) motors.

Contents

1. Introduction to magnetic circuits
2. DC Motors: Working principle, construction, operation, parts, types, and characteristics.
3. Speed. Control of DC Motor: voltage and field current control method, effects of open field.
4. DC Series Motor: Torque, applications, terminal characteristics, methods for speed. control.
5. DC Generator: Types, equivalent circuit, characteristic and voltage build-up phenomenon
6. Armature Reaction: Concept, causes, components, effects and remed.ies.
7. Commutation: Commutation process, difficulties, Ldi/dt effect, interpoles.
8. Losses: Types, formulation, power flow diagram, efficiency and calculations.
9. Armature Winding: Parameters, multiplex windings, lap winding, wave winding, design examples.
10. Transformer: Principle, operation, types, construction and applications.
11. Transformer Equivalent Circuit and Phasor Diagram
12. Transformer Tests and Voltage Regulations: Open and short circuit test, voltage regulation.
13. Auto Transformer: Basic principle, construction and working, voltage and current relationship,
14. Three Phase Transformers: Types, ratings, different type of connections.
15. Introduction to AC Machines: Types, parts, Nature, reversal and speed. of revolving magnetic field.
16. Induction Motor: Construction, working, principle, torque, types, rotor frequency, merits, demerits.
17. Power and Torque Calculations: Power flow diagram, losses, rotor currents, characteristics.
18. Speed. Control of Induction Motor and Starting
19. Tests on Induction Motor: No load test, blocked. rotor test, resistance test and calculations.
20. Induction Generator: Principle, working and construction, Voltage build up and its applications.
21. BLDC, Switched. Reluctance, Hysteresis & Servo Motors: Construction, working and application.

Recommended Texts

1. Stephen J. Chapman. (2012). *Electric Machinery Fundamental* (5th Ed.). New York: McGraw-Hill International.

Suggested Readings

1. A.E. Fitzgerald. (2003). *Electric Machinery* (6th Ed.). New York: McGraw-Hill International.
2. Charles I. Hubert, P.R. (2001). *Electric Machines: Theory, Operating Applications, and Controls* (2nd Ed.). NJ: Prentice Hall.

EE-212 **Electrical Machines (Lab)** **1 (0+1)**

The objective of the Electrical Machines Laboratory is to portray the concepts of DC and AC machines to students. As far as DC machines are concerned., it deals with working principle of Direct Current and different types including operation as generator and motor. Additionally, it aims to impart knowled.ge on construction, performance and principle of operation of AC machines covering single phase and three phase transformers, synchronous and asynchronous machines and analyze their performance.

Contents

1. Introduction to working principle of dc machine and its various parts
2. Determine armature and field resistance of a dc shunt generator and study its open circuit characteristics.
3. Perform the load test of a DC shunt generator.
4. Perform the load test of a DC series generator.
5. Perform the load test of a DC compound generator.
6. Determine torque speed. characteristics of a DC series motor.
7. Analyze torque speed. characteristics of a DC shunt motor.
8. Analyze torque speed. characteristics of a DC compound motor.
9. Open circuit and short circuit test on single phase transformer and determine parameters of its equivalent circuit
10. Study 3 phase transformers and its various connections star/star, star/delta, delta/star and delta/delta.
11. Perform the block rotor or short rotor test on single phase induction motor.
12. Study no load and short circuit test on three phase alternators and draw open and short circuit characteristics.
13. Determine voltage regulation of an alternator by zero power factor method.
14. Find out synchronization of an alternator with an infinite bus by dark lamp method.

Recommended Texts

1. Stephen J. Chapman. (2012). *Electric Machinery Fundamental* (5th Ed.). New York: McGraw-Hill International.

Suggested Readings

1. A.E. Fitzgerald. (2003). *Electric Machinery* (6th Ed.). New York: McGraw-Hill International.
2. Charles I. Hubert, P.R. (2001). *Electric Machines: Theory, Operating Applications, and Controls* (2nd Ed.). NJ: Prentice Hall.

EE-213 **Electronic Devices and Circuits** **4 (3+1)**

The main aim of this course is to provide a platform for students to understand working of semiconductor devices such as Diode, BJT, MOSFET, JFET, and circuits and systems like amplifiers. Students are also taught to analyze circuits using these semiconductor devices. This is one of the foundation courses which are required. for students to understand the working of complex electronic circuits and systems.

Contents

1 Introduction: Basic physics of semiconductors, Covalent bonding and intrinsic materials, Semiconductors materials and their properties
2 Semiconductor diode: Structure and I-V characteristics of diode, Ideal diode model
3 Diode circuits: Diode circuit analysis, Diode circuit applications (Rectifiers, Clipper and Clampers)
4 Special types of Diodes: Structure and characteristics of special purpose diodes (Zener Diode, Light Emitting Diode, Laser Diode, Photo Diode, Tunnel Diode, Varactor Diode)
5 Bipolar Junction Transistors: Structure, Physical operation, I-V characteristics, and modes of operation
6 BJT Circuits and Configurations: Common-Base configuration, Common-Emitter configuration, Common-Collector configuration
7 BJT DC-Biasing Techniques: Collector feed.back configuration, Emitter follower configuration, Common-Base Configuration, PNP Transistors
8 Field Effect Transistor: Construction and characteristics of JFETs, Transfer Characteristics
9 FET Biasing Techniques: Fixed. biased. configuration, Self-Bias configuration, Voltage-divider bias configuration
10 Metal–oxide–semiconductor Field-effect Transistor (MOSFETS): Structure, physical operation, I-V characteristics of Depletion-Type MOSFET and Enhancement-Type MOSFET
11 MOSFET Biasing Techniques: Depletion-Type MOSFET and Enhancement-Type MOSFET
12 BJT AC Models: Amplification in the AC Domain, BJT Transistor Modeling, The re Transistor Model, Common Emitter Fixed.-Bias
13 FET Amplifiers: JFET Small-Signal Model, Fixed. Bias Configuration, Self-Bias Configuration
14 Operational Amplifiers: Introduction, Op-Amp Basics, Inverting Amplifiers, Non-inverting Amplifiers, Summing Amplifiers, Difference Amplifiers
15 Operational Amplifiers Applications

Recommended Texts

1. Robert L. Boylestad, Louis Nashelsky. (2016). *Electronic Devices and Circuit Theory* (11th ed.). NY: Pearson.

Suggested Readings

1. Behzad Razavi, P.E (2013). *Fundamentals of Microelectronics* (2nd ed.). NY: John Wiley and Sons. Inc
2. A. S. Sed.ra and K. C. Smith, P.E. (2019). *Microelectronic Circuits*. Oxford: Oxford University Press.
3. Jim Fry, P.E. (1986). *Semiconductor Devices* (3rd ed.). UK: Heath Company.

EE-213 Electronic Devices and Circuits (Lab) 1 (0+1)

The laboratory emphasizes the practical, hands-on component of this course. It complements the theoretical material presented. in lecture, and as such, is integral and indispensable to the mastery of the subject. There are several items of importance here including proper safety proced.ures, required. tools, and laboratory reports. This exercise will finish with an examination of scientific and engineering notation, the standard form of representing and manipulating values.

Contents

1. Introduction to Laboratory Equipment.
2. Characteristics of Diode, half wave and full wave rectification.
3. BJTs Common Emitter Input/ Output Characteristics and Operating Regions.
4. BJTs Common Base Input/ Output Characteristics.
5. BJTs Common Collector Input/ Output Characteristics.
6. BJT Voltage Divider & Emitter Feed.back Configuration.
7. FET input/output Characteristics.
8. Characteristics of MOSFET in Enhancement Mode.
9. Characteristics of MOSFET in Depletion Mode.
10. MOSFET Digital-Gates Circuit.
11. Inverting and Non-Inverting Amplifiers behavior of Operational Amplifier.
12. BJT Common Emitter Amplifier Configuration.
13. BJT Common Base Amplifier Configuration.
14. Design Project.

Recommended. Text

1. Electronic devices and circuits Lab manual

Suggested. Reading

1. Electronic devices and circuits Lab manual

MATH-214 **Complex Variables and Transforms** **3 (3+0)**

Complex numbers play a vital role in electrical engineering curriculum especially when we study Alternating Current (AC) concepts or when we workout the frequency domain analysis and design. This course is specifically designed. to ed.ucate students about the complex number system, the associated. transforms and their uses in various fields of electrical engineering.

Contents

1. Complex numbers, the concept, basic operations and properties
2. Complex functions
3. Complex integration
4. Sequence and series, convergence and divergence, Taylor series, Power series, Laurent series
5. Laplace transform, inverse Laplace transform, properties of Laplace transform
6. Using Laplace transform to solve ODEs
7. Fourier transform
8. Z-Transform
9. Introduction to PDEs

Recommended Texts

1. D. G. Zill, Patrik D Shanahan. (2003). *A first course in complex analysis with applications* (3rd ed.). Burlington: Jones and Barlett Publishers Inc.
2. Brown J. W.& Churchill R. V. (2004). *Complex Variables and Applications* (8th ed.). New York: McGraw-Hill ed.ucation.

Suggested Readings

1. E. Kreyszig. (2011). *Advance engineering mathematics* (10th ed.). New York: John Wiley and sons Inc.

ENG-215 **Technical Report Writing** **3 (3+0)**

The main aim of this course is to describe technical writing, its importance, purpose, characteristics and how it is different from ordinary writing which will enhance language skills and develop critical thinking. This course is an introductory course on technical report writing. It is designed. for students in engineering and other related. fields. It introduces students to different types of technical documents that they will have to write after graduation in the professional life. It allows students to analyze the situation and choose appropriate technical document to communicate effectively in a professional environment.

Contents

1. Basics of Academic Writing, how is Academic Writing Different from Technical Writing,
2. Overview of various kinds of essays (for comparison), Class discussion on the differences between technical and academic writing
3. What is a Research Proposal? Research Article etc., Style, content, language, form, clarity and consistency in writing
4. Introduction to in-text citation methods, footnotes, endnotes, bibliography in academic writing
5. What is a letter? Letter format. Letter writing tone.
6. What is Memorandum? Format of memorandum
7. What is an email? Format of an email.
8. Problems encountered. while writing email. Effective vs ineffective subject lines.
9. Introduction to Technical Report Writing, Importance of Technical Report Writing, Purpose of Technical Report Writing
10. Characteristics and style of Technical Report Writing.
11. Analysis of various User's Manuals, Product Descriptions and Warning Labels as technical report writing samples
12. Presentation Skills
13. Presentations on given topics

Recommended Texts

1. Langan, J. (2013). *College writing skills with readings*. New York: McGraw-Hill ed.ucation.

Suggested Readings

1. Kirszner, L. G., & Mandell, S. R. (2011). *Patterns for college writing: A rhetorical reader and guide*. New York: Macmillan.

EE-221 **Instrumentation and Measurements** **4 (3+1)**

Conducting experiments and making measurements is an essential aspect of all branches of science and engineering. Nearly all of our current quantitative understanding of the natural and engineered. world has come from the interplay between theory and measurements. Models and simulations of systems require experimental validation and performance of engineered. systems must not only be pred.icted., but also measured. and tested. In this course students will learn the basic terminologies related. to measurement system design, instrument types, statistical analysis, and types of error in measurement. The course then covers different electronic and digital measuring instruments, e.g. Digital and Analog meters, Oscilloscopes, Signal Generators, Bridges, Transducers and sensors are included. It also equips the students with mathematical techniques and skills to handle the instruments in industry.

Contents

1. Fundamentals of measurements systems, measurements system design and applications.
2. Instruments types and their applications.
3. Instruments static performance characteristics.
4. Instruments dynamics performance characteristics.
5. Measurement uncertainty, sources of systematic error, red.uction of systematic errors.
6. Quantification of systematic errors.
7. Variable conversion elements (DC-bridge circuits).
8. Variable conversion elements (AC-bridge circuits).
9. Signal conditioning (Filtering and Amplification).
10. Signal conditioning (Rectification, Linearization, Isolation and ADC/DAC).
11. Electrical indicating and test instruments (Analog and Digital meters).
12. Electrical indicating and test instruments (Oscilloscopes and Function generators).
13. Transducers (Strain Gauge, Thermistors and Thermocouple).
14. Transducers (LVDT, Force and pressure transducers).
15. Sensors, choosing a sensor and need. for sensors.
16. Sensors types (Motion, temperature, light, Magnetic field and Ultrasonic sensors).

Recommended Texts

1. Morris, A. S., & Langari, R. (2015). *Measurement and Instrumentation Theory and Application* (2nd ed.). United. States: Academic Press.

Suggested Readings

1. Klaassen, K. B., & Gee, S. (1996). *Electronic Measurement and Instrumentation* (2nd ed.). United. Kingdom: Cambridge University Press.
2. Helfrick. A. D., & Cooper, W. D. (1989). *Modern Electronic Instrumentation and Measurement Technology*. NJ: Prentice Hall.

EE-221 Instrumentation and Measurements (Lab) 1 (0+1)

This course, using laboratory practice, describes and illustrates fundamentals of measurements and measuring instruments related. to engineering. The objective of this Lab is to help students understand the use of sensors, transducers and measuring instruments. The laboratory emphasizes the practical, hands-on component of this course. It complements the theoretical material presented. in lecture, and as such, is integral and indispensable to the mastery of the subject. There are several items of importance here including proper safety proced.ures, required. tools, and laboratory reports. This exercise will finish with an examination of scientific and engineering notation, the standard form of representing and manipulating values.

Contents

1. Working and characteristics of various types of meters.
2. Measurement of Unknown Resistance by using Wheatstone Bridge Method.
3. Measurement of the low resistance by using Kelvin Double Bridge Method.
4. Describe the construction and characteristics of temperature transducers.
5. Describe the construction and characteristics of platinum R.T.D resistance transducer.
6. Describe the construction and characteristics of a thermocouple.
7. Describe the construction and characteristics of an NTC thermistor.
8. Describe the characteristics of The Linear Variable Differential Transformer (LVDT) transducer.
9. Describe the construction and characteristics of an air flow transducer.
10. Describe the construction and characteristics of an air pressure transducer.
11. Discuss the characteristics of NTC thermistor bridge circuits.
12. Characteristics of an ON/OFF Temperature Control System.
13. Introduction to LabVIEW.
14. Study of Data Acquisition system using LabVIEW Software.
15. Design Project.

Recommended Texts

1. Course Lab Manual
2. Morris, A. S., & Langari, R. (2015). *Measurement and Instrumentation Theory and Application* (2nd ed.). US: Academic Press.

Suggested Readings

1. Klaassen, K. B., & Gee, S. (1996). *Electronic Measurement and Instrumentation* (2nd ed.). United. Kingdom: Cambridge University Press

EE-222 **Electronic Circuit Design** **4 (3+1)**

Electronic circuit design is one of the most practical courses for electronic design engineers. This course fully utilizes knowled.ge learned. in all the fundamental electric and electronic circuits for advanced. circuit modeling, design, and analysis. Throughout this course, students will gain circuit design skills and apply them to real-world electronic product development. First portion of this course introduces construction and examination of small signal and power amplifiers. In the second portion, students will design and analyze various small-scale electronic circuits based. on operational amplifier including active filters and oscillators. Finally, third portion is to analyze low and high frequency responses of BJT and FET amplifiers and the stability concepts of oscillators. After this course, students should have a strong intuition and insight of the various discrete and integrated. amplifiers, which can be further used. to design and optimize circuits' performance. This includes the modelling, biasing, gain and frequency response of such amplifiers. Operational amplifiers and its circuits should be in the grasp of the student.

Contents

1. Amplification: r'e model and equivalent circuit of BJT amplifier
2. Hybrid model and equivalent circuit of BJT amplifier
3. Capacitor and direct coupled. multistage amplifiers
4. Class A and Class B power amplifiers
5. Class AB and Class C power amplifiers
6. FET Small Signal Analysis: FET AC models and amplifier operation
7. MOSFET Small Signal Analysis: AC models and amplifier operation
8. Operational Amplifiers: Input modes and parameters, Summing Amplifiers
9. Active filters: Filter responses and characteristics, Active Low Pass filters
10. Active High Pass and Band Pass filters, Sallen-key configuration
11. Oscillators: operating principle and classifications of oscillators
12. Oscillators with RC feed.back: Wein-Bridge and Phase Shift oscillators
13. Oscillators with LC feed.back: Colpitts, Clapp and Hartley oscillators
14. Frequency characteristics and stability analysis of oscillators
15. Low frequency response of BJT and FET amplifiers
16. High frequency response of BJT and FET amplifiers
17. Total frequency response of BJT and FET amplifiers

Recommended Texts

1. Sed.ra, A. S., & Kenneth C. (2019). *Microelectronic Circuits* (8th ed.). United. Kingdom: Oxford University Press.
2. Floyd, T . L. (2018). *Electronic Devices* (10th ed.). United. Kingdom: Pearson.

Suggested Readings

1. Boylestad, R. L., & Nashelsky, L. (2013). *Electronic Devices and Circuit Theory* (11th ed.). United. Kingdom: Pearson.
2. Razavi, B. *(2013). Fundamentals of Microelectronics* (2nd ed.). New York: John Wiley and Sons Inc.

EE-222 **Electronic Circuit Design (Lab)** **1 (0+1)**

Electronic circuit design is one of the most practical courses for electronic design engineers. This course fully utilizes knowled.ge learned. in all the fundamental electric and electronic circuits for advanced. circuit modeling, design, and analysis. Throughout this lab work, students will gain circuit design skills and apply them to real-world electronic product development. First portion of this lab introduces construction and examination of small signal and power amplifiers. In the second portion, students will design and analyze various small-scale electronic circuits based. on operational amplifier including active filters and oscillators. Finally, third portion is to analyze low and high frequency responses of BJT and FET amplifiers and the stability concepts of oscillators. After this lab, students should have a strong intuition and insight of the various discrete and integrated. amplifiers, which can be further used. to design and optimize circuits' performance. This includes the modelling, biasing, gain and frequency response of such amplifiers. Operational amplifiers and its circuits should be in the grasp of the student.

Contents

1. Common Emitter amplifier
2. Multistage amplifiers
3. Class A amplifiers
4. Class B and class AB amplifiers
5. Common Source Amplifier using JFET
6. Common Drain and common gate JFET Amplifier
7. Op Amp as Inverting and non-inverting amplifier and voltage Follower
8. Op amp as summing and difference amplifier
9. Op Amp as Integrator and Differentiator
10. Implementation of Active Filters
11. Wein bridge oscillator
12. Colpitt and Hartley oscillator
13. Frequency response of BJTs
14. Frequency response of FETs

Recommended Texts

1. Sed.ra, A. S., & Kenneth C. (2019). *Microelectronic Circuits,* (8^{th} ed.). Oxford: Oxford University Press.
2. Floyd, T. L. (2018). *Electronic Devices* (10^{th} ed.). UK: Pearson.

Suggested Readings

1. Boylestad, R. L., & Nashelsky, L. (2016). *Electronic Devices and Circuit Theory* (11^{th} ed.). UK: Pearson.

STAT-223 **Engineering Probability and Statistics** **3 (3+0)**

Probability theory is the branch of mathematics that deals with modelling uncertainty. It is important because of its direct application in areas such as genetics, finance, telecommunications and engineering. This course is designed. to establish conceptual framework about handling and understanding uncertain events probability and probability distributional approach, set theory, basic probability axioms and rules and the moments of discrete and continuous random variables as well as be familiar with common named. discrete and continuous random variables in the field of engineering. This course enables the students to understand how to derive the probability density function of transformations of random variables and use these techniques to generate data from various distributions, how to calculate probabilities, and derive the conditional distributions of random variables, events, probability of an events. Methods on computations on Total probability theorem and Bayes theorem with implementation on real life phenomenon are also provided. This course aims mathematical derivation and manipulation of discrete type and continuous type distributions with their properties like completeness of p.d.f, mean, variances, mgf. This course also emphasizes on the uses of regression and correlation in the field of engineering. There is an emphasis placed. on real-world applications to engineering problems.

Contents

1. Set Theory
2. Basic Concepts of Probability.
3. Conditional Probability, Independent events
4. Baye's Theorem
5. Discrete and continuous random variables
6. Distributions and density functions
7. Probability distributions
8. Discrete distributions (Binomial, Poisson, Hypergeometric, Geometric and Negative Binomial distribution)
9. Continuous distributions (Normal and Exponential distributions)
10. Properties of distributions (mean, variance, standard deviation, moments and moment generating functions)
11. Linear regression and Correlation, Curve fitting

Recommended Texts

1. Sheldon Ross. (2002). *A First Course in Probability (6th ed.).* UK: Pearson ed.ucation.
2. Vijay K. Rohatgi and A. K. Md. Ehsanes Saleh. (2015). *An Introduction to Probability and Statistics*. (3rd ed.). USA: Wiley.

Suggested Readings

1. Joseph K. Blitzstein and Jessica Hwang. (2019). *Introduction to Probability* (2nd ed.). USA: Athena Scientific
2. Hogg, R.M. and Craig, A.T. (2018). *Introduction to Mathematical Statistics* (8th ed.). New York: MacMillan Co.
3. John Rice. (2006). *Mathematical Statistics and Data Analysis*. India: Duxbury Press.

ME-224 **APPLIED. THERMODYNAMICS** **3 (3+0)**

This course provides an overview of applied. thermodynamics. Topics include pressure; temperature; heat and heat transfer; properties of substances; First Law of Thermodynamics and its application; Second Law of Thermodynamics and its application; analysis of power and refrigeration cycles. Furthermore the students will be able to understand the application of the steady-flow energy equation or the First Law of Thermodynamics to a system of thermodynamic components (heaters, coolers, pumps, turbines, pistons, etc.) to estimate required. balances of heat, work and energy flow. (homework, quiz, self-assessment, PRS)

Contents

1. Basic Concepts and Definitions of Thermodynamics
2. Process and Cycle, Concepts of Thermodynamics
3. Properties and Definitions of State
4. First law of Thermodynamics (Work and Heat as energies in transition)
5. Interchangeability of energy states
6. Working fluids of Thermodynamics
7. Steady/Unsteady Flow Energy Equations
8. Perfect and Real Gases
9. Second Law of Thermodynamics
10. Reversible and Irreversible Processes
11. Entropy and Carnot Efficiency concept of available energy

Recommended Texts

1 Yunus A. C, Michael A.(2000), *Thermodynamics: An Engineering Approach*. USA: McGraw-Hill.
2. Moran M. J. and Shapiro H. O.(2002), *Fundamentals of Engineering Thermodynamics*. USA: John Wiley & Sons

Suggested Readings

1. Sonntang, B., Van W.(2006) John, *Fundamentals of Thermodynamics*. USA: Wiley & Sons

EE-225 **Electrical Network Analysis** **4 (3+1)**

The aim of this course is the study of fundamental concepts of alternating current analysis both in single phase and three phase circuits. To equip the students with the knowled.ge and techniques of analyzing Electrical Networks. The course introduces the analysis of AC circuits (comprising resistors, capacitors & inductors) excited. by sinusoidal sources. The concept of complex frequency, single-phase circuit analysis, Phasors, imped.ance, star-delta transformation, and Application of Laplace Transforms in circuits analysis. After successful completion of this course, the student should be able to: Use Kirchhoff's laws, circuit theorems, and node voltage methodology to solve. AC circuit, 2nd order transient circuits. Apply steady state sinusoidal analysis to circuits. Understanding of phasors diagrams for AC circuit analysis. Understanding of transformer operation. Apply Laplace Transformation and two-port networks. The main objective is to make students familiar with the modern hierarchy of AC circuit examination and explain to them the state-of-the-art electrical network analysis.

Contents

1. Analyzing First order & 2nd order circuits / Step response of RL, RC & RLC Circuits.
2. Finding initial & final value, General Second order circuits deriving equations
3. AC Steady State Analysis, Phasors Relationships for Circuit Elements, Imped.ance & Admittance, Kirchhoff's Laws in the Frequency Domain.
4. Star-delta transformation in DC & AC, voltage-division relationship & current-division principle
5. AC Network Theorems, AC Circuit Analysis using Nodal Analysis & Super Node
6. AC Circuit Analysis using Mesh Analysis, and Super Mesh
7. Analyzing circuit using Superposition Theorem and Source Transformation Theorem
8. Thevenin Theorem and Norton Theorem.
9. AC Power Analysis, Instantaneous and Average Power, Effective or RMS Value
10. Maximum Power Transfer Theorem, Apparent Power, Power Triangle, Power Factor, and Power Factor Correction
11. Poly-phase circuits, phase sequence, vector diagrams for balance and unbalanced. three phase networks, balanced. three-phase voltages, power in a balanced. system.
12. Introduction to magnetically coupled. circuits, Q-Factor, mutual inductance and transformers
13. Understanding the Laplace & inverse Laplace transformation, properties of Laplace transformation.
14. Application of Laplace transform, circuit element model, circuit analysis
15. Transfer function and their application as network stability, initial and final value theorems.
16. Understanding the concept of Two-Port networks, (Z, Y, h, T & g Parameters).

Recommended Texts

1. Charles K. Alexander and Matthew Sadiku. (2013). *Fundamentals of Electric Circuits* (5th ed.). New York McGraw- Hill International.

Suggested Readings

1. J. D. Irwin and R. M. Nelms. (2008). *Basic Engineering Circuit Analysis* (9th ed.). New Jersey: Wiley.

EE-225 **Electrical Network Analysis (Lab)** **1 (0+1)**

This is a second course in electric circuit theory. The objective of the course is to introduce the students to advance techniques of ac circuit analysis and design. The topics to be covered. include Laplace transform, analysis using Phasors and Laplace transform, Introduction to Bode plots and frequency response analysis using Fourier Transform, single and three phase ac power systems, Two-port Networks Parameters. Thus lab will cover the experiments to make students understand the use of phasor techniques to solve the circuits, to study pulse and steady state responses, and to draw and use bode plot for frequency responses of single phase circuits, to understand basic concepts related. to series and parallel connection of RL, RC and RLC circuits. It is expected. from the students at the end of semester to implement, build and test group project in a team environment with minimal direction from the instructor.

Contents

1. To examine the pulse response of a series RL network
2. To study the steady state sinusoidal response (RC and RL circuits) and phasors
3. To show the resonant frequency of a series RLC circuit is given by $1/(2\pi\sqrt{LC})$ and to plot the frequency response of an RLC circuit
4. To plot the magnitude and phase response of passive low pass and high pass RC filters
5. To study the frequency characteristics of passive low pass and high pass RL filter circuits
6. Implementation of first order Active low pass and high pass filter
7. To plot the magnitude and phase response of a series resonant band-pass filter
8. To plot the magnitude and phase response of a series resonant band-stop filter
9. To plot the magnitude and phase response of an Active Band Pass and Band Stop filters
10. To obtain the frequency response of an active low pass filter for the desired. cut off frequency
11. To obtain the frequency response of an active high pass filter for the desired. cut off frequency
12. To obtain the frequency response of an active band pass filter for the desired. cut off frequency and to verify the roll off
13. To obtain the frequency response of an active band reject filter for the desired. cut off frequency and to verify the roll off
14. Design PROJECT

Recommended Texts

1. C. Alexander and M. Sadiku. (2013). *Fundamentals of Electric Circuits* (5^{th} ed.). USA: McGraw-Hill.

Suggested Readings

1. J. D. Irwin and R. M. Nelms (2008). *Basic Engineering Circuit Analysis* (9^{th} ed.). USA: Wiley.
2. S. Franco. (1994). *Electric Circuits Fundamentals.* Oxford: Oxford University Press.
3. R E Thomas, A. J. Rosa and G. J. Toussaint (2009). *The Analysis and Design of Linear Circuits* (6th Ed.ition). USA: John Wiley and Sons.

EE-311 **Signals and Systems** **4 (3+1)**

This course is an introductory course on Signals and Systems. It is designed. for students in engineering and other related. fields. It introduces students to the concepts of signals, systems and their relationship. Additionally, this course deals with signals, systems, and transforms, from their theoretical mathematical foundations to practical implementation in circuits and computer algorithms. At the conclusion of the course, the students should have a deep understanding of the mathematics and practical issues of signals in continuous and discrete time, linear time-invariant systems, convolution, and Fourier transforms

Contents

1. Continuous time and discrete time signals
2. Some special signals: Periodic signals, even and odd signals, exponential and sinusoidal signals, the unit impulse and unit step functions
3. Continues time and discrete time systems
4. Linear time invariant (LTI) systems
5. Difference equation, causality and BIBO stability
6. Convolution and correlation
7. Discrete time Fourier transforms, time and frequency characterization of signals and systems
8. Analysis of Continuous time systems using Laplace transform
9. The sampling theorem, Aliasing
10. Sampling of discrete time signals

Recommended Texts

1. Alan V. Oppenheim, A. S. Willsky and S. H. Nawab. (1997). *Signals and Systems* (2nd ed.). Essex: Pearson Ed.ucation Limited.

Suggested Readings

1. Michael J. Roberts. (2008). *Fundamentals of Signals and Systems* (2nd ed.). New York: McGraw-Hill Higher Ed.ucation
2. B. P. Lathi. (2015). *Linear Systems and Signals* (2nd ed.*)*. Oxford: Oxford University Press.

EE-312 **Electromagnetic Field Theory** **3 (3+0)**

Electromagnetic Theory covers the basic principles of electromagnetism: experimental basis, electrostatics, magnetic fields of steady currents, motional e.m.f. and electromagnetic induction, Maxwell's equations, propagation and radiation of electromagnetic waves, electric and magnetic properties of matter, and conservation laws. The depth and breadth of electromagnetism, the foundation for many fields including materials science, electrical engineering, and physical chemistry, requires a long, steep, and steady learning curve. This course aims to bridge the gap between the fundamental principles taught in electromagnetism and its practical application to specific fields such as materials, physics, and chemistry related. to energy storage and harvesting. The goal of Electrodynamics: An Introduction is to not only teach electromagnetism but also introduce some mathematical tools which can be used. to solve problems in the subject. Within these lecture notes, we review vector calculus and explain how to use fields to visualize the topics we cover. Furthermore, this course has applications in exploring intermolecular forces, and qualities of capacitors. Through this, we relate electromagnetism to more conventionally studied. topics and its application to specific research topics related. to energy storage and harvesting.

Contents

1. Vector algebra, Cartesian, cylindrical and spherical coordinate systems
2. Relationship between different co-ordinate systems, Transformation of vectors
3. Coulombs law and electric field intensity
4. Electric field due to different charge distributions
5. Electric field arising from an infinite line and sheet of charges with examples
6. Electric flux density, Gauss’s law: Applications of Gauss’s law
7. Divergence and divergence theorem, Maxwell’s first Equation
8. Work done, Potential difference and absolute potential
9. Potential field due to different charge distributions
10. Potential gradient, Electric dipole, Energy density
11. Continuity of current, OHM’s law
12. Polarization of dielectric materials
13. Boundary conditions for conductor and dielectric materials
14. Capacitance calculation of parallel plate and two wire line using boundary conditions
15. Poisson’s and Laplace’s equations with examples
16. Biot-Savart and Ampere’s circuital laws
17. Curl and stokes’ theorem
18. Magnetic flux density, Scalar and vector magnetic Potentials, Steady magnetic field laws
19. Forces and torques on current carrying conductors
20. Nature of Magnetic materials and boundary conditions
21. Magnetic circuit, Potential energy and forces on magnetic materials
22. Inductance and mutual inductance
23. Faraday’s law and displacement current
24. Maxwell’s Equations in point and integral form, The Retarded. potentials

Recommended Texts

1. William Hayt and John A. Buck (2001). *Engineering Electromagnetics* (6th ed.). NY: McGraw Hill ed.ucation.

Suggested. *Readings*

1. Sadiku, Matthew N. (2018). *Elements of Electromagnetics* (7th ed.). Oxford: Oxford University Press.
2. David K. Cheng. (2019). *Fundamentals of Engineering Electromagnetics* (1st ed.). UK: Pearson.

EE-313 **Microprocessor Systems** **4 (3+1)**

Microprocessor Systems course introduces small microprocessor-based. systems, with an emphasis on embed.ded. system hardware and software design to the students of electrical and computer engineering. This course fully utilizes the knowled.ge learned. in the fundamentals of digital logic design, computer architecture and programming languages. First portion of this course introduces the basics of microprocessor and microcontroller along with the architectures of 8-bit and 16-bit microprocessors. Students will learn the architectural issues of simple 1-bit microprocessor concluding to 8086(16-bit) microprocessor architecture. Second portion of the course emphases on interface the memory and I/O devices with 8086 microprocessors. Students will be able to design the decoding circuitry for interfacing memory and basic I/O devices with microprocessor. Further, basic I/O controllers for interfacing are also included. Finally, third portion is to apply the concepts of assembly language programming to write the 8086 assembly language programs containing arithmetic, logic, loop, and program control instructions.

Contents

1. Basic computer structure and simple 1-bit microprocessor
2. 8-bit Microprocessor (8085): pins, features and architecture
3. Instruction set and timing diagrams of 8085 microprocessor
4. 16-bit Microprocessor (8086): pins, features and architecture
5. Addressing modes and Interrupts of 8086 microprocessor
6. Interfacing memory devices with 8085 microprocessors
7. Memory organization of 9086 microprocessor
8. Interfacing memory devices with 8086 microprocessors: Address decoding techniques
9. I/O Interfacing (8086): I/O devices and controllers, I/O modes in Computer System
10. 8255 Programmable Peripheral Interface: pins, Internal architecture and Working modes
11. 8259 Priority Interrupt Peripheral Controller: pins, Internal architecture and Working modes
12. Assembly Language Programming (8086): syntax, rules of assembly languages and data representation
13. Assembly Language Programming (8086): variable declaration and assembler directives
14. Instruction Types: arithmetic, data, logical and program control instructions
15. Assembly language programs of data transfer and logical instructions
16. Assembly language programs of arithmetic and program control instructions

Recommended Texts

1. Hall, D. V. (2012). *Microprocessor and Interfacing* (3rd ed.). New York: McGraw-Hill International.
2. Gilmore, C. (1995). *Microprocessors: Principles and Application* (3rd ed.). New York: McGraw-Hill International.

Suggested Readings

1. Antonakos, J. L. (1999). *An Introduction to the Intel Family of Microprocessors* (3rd ed.). NJ: Prentice Hall.
2. Brey, B. B. (2006). *The Intel Microprocessors 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium, and Pentium Pro Processor Architecture, Programming, and Interfacing* (8th ed.). NJ: Prentice Hall.

EE-313 **Microprocessor Systems (Lab)** **1 (0+1)**

Microprocessor Systems lab work introduces small microprocessor-based. systems, with an emphasis on embed.ded. system hardware and software design to the students of electrical and computer engineering. This lab fully utilizes the knowled.ge learned. in the fundamentals of digital logic design, computer architecture and programming languages. Students will learn the architectural issues of simple 1-bit microprocessors. Students will be able to apply the concepts of assembly language programming to write the 8086 assembly language programs containing arithmetic, logic, loop, and program control instructions.

Contents

1. Introduction to Proteus
2. Simulation of 2-bit ALU.
3. Simulation of 4-bit Register.
4. Simulation model design for complete simple microprocessor.
5. Programming and simulation of a complete simple microprocessor.
6. Introduction to VCM-8609 trainer
7. Programming and Running a simple assembly program for 8086.
8. Performing Logic operations in assembly language.
9. Using Program control instructions in assembly language.
10. Using an Interrupt System of 8086 microprocessor.
11. 8086 LED. interfacing using 8255A.
12. 8086 7-SEGMENT interfacing using 8255A.
13. Mapping C language code in Assembly language.

Recommended Texts

1. Hall, D. V. (2012). *Microprocessor and Interfacing* (3rd ed.). New York: McGraw-Hill International.
2. Gilmore, C. (1995). *Microprocessors: Principles and Application* (3rd ed.). New York: McGraw-Hill International.

Suggested Readings

1. Antonakos, J. L. (1999). *An Introduction to the Intel Family of Microprocessors* (3rd ed.). NJ: Prentice Hall.
2. Brey, B. B. (2006). *The Intel Microprocessors 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium, and Pentium Pro Processor Architecture, Programming, and Interfacing* (8th ed.). NJ: Prentice Hall.

MATH-314 **Numerical Analysis** **3 (3+0)**

The objective of this course is to teach the use of computers for the numerical solution of engineering problems. This course focuses on basic ideas of reviewing and developing basic characteristics of numerical algorithms (convergence, approximation, stability, computational complexity and so on), and will illustrate the students with several classic problems in numerical mathematics. The students will also work on implementing abstract mathematical constructions into working prototypes of numerical code. Upon completion of this course, the students will have an overview of the main ideas of numerical computing and will have a solid foundation for reading up on and working with more advanced. numerical need.s of your specific subject area.

Contents

1. Floating point number system, error analysis, solutions of equations
2. Interpolation, Polynomial Interpolation, Divided. Difference Interpolation Formula
3. Hermite Interpolation, Cubic Spline Interpolation, splines
4. Numerical differentiation, Differentiation of Interpolating Polynomials
5. Method of Undetermined. Coefficients, Extrapolation Method, numerical integration
6. Newton-Cotes Quadrature Formulas, Extrapolation Methods, Gaussian Quadrature
7. Roundoff Error, Weight Function, Gaussian numerical integration
8. Numerical methods in linear algebra, systems of linear equations, method of least squares
9. Secant Method, Newton-Raphson Method, Muller’s Method, Newton's Method
10. Eigenvalues, eigenvectors, the power method, Jacobi’s method
11. Solution of ordinary and partial differential equations
12. Extensive computer exercises

Recommended Texts

1. Steven C. Chapra and Raymond P. Canale (2006). *Numerical Methods for Engineers* (5th ed.). USA: McGraw-Hill.

Suggested Readings

1. Curtis F. Gerald. (2003). *Applied. Numerical Analysis* (7th ed.). Boston: Addison Wesley.

CE-315 **Data Structures and Algorithms** **4(3+1)**

The main aim of this course is to understand the basic data structures and the abstract data structures and user defined. data structures and their applications to represent various information types. Design and analysis of various algorithms for solving various searching, and sorting problems. This course is an introductory course on Data Structures and Algorithms. It is designed. for students in engineering and other related. fields. It introduces students to different data structures available which can be used. in various algorithms. It allows students to analyze and choose appropriate data structure to the problems that may arise within the context. It also enables the students to analyze the time complexities of different algorithms with respect to the input size.

Contents

1. Introduction to the Course outline: Data types, Abstract data types, Sequential allocation, Linked. allocation
2. Arrays: Linear Arrays, Representation of arrays in memory, Traversing, insertion and deletion in arrays
3. Linear Search, Binary Search
4. Pointers and Records: Pointer, pointer arrays, Records, record structure.
5. Introduction to Linked. Lists, Representation of linked. lists in memory, Traversing, Searching, Insertion and Deletion in Linked. Lists,
6. Header Linked. Lists, Two-Way Linked. Lists
7. Stacks Introduction, Sequential and Linked. Representation
8. Queues, Sequential and Linked. Representation
9. Arithmetic Expressions; Polish Notations, Quicksort, an Application of Stacks
10. Recursion, Tower of Hanoi,
11. Binary Trees, Representing Binary Trees in Memory, Traversing Binary Trees
12. Binary Search Trees, Searching and Inserting in BST, Deleting in BST
13. Heap, Heapsort
14. Introduction, Graph theory terminology, Sequential Representation of Graphs, Adjacency Matrix
15. Path Matrix, Warshalls Algorihtm, Shortest Path, Linked. Representation of a Graph
16. Traversing a Graph, BFS, DFS
17. Introduction to Sorting, Insertion Sort, Selection Sort, Merging, Merge Sort, Radix

Recommended Texts

1. Lipschutz, S. (2009). *Data Structure with C*. India: Schaum Series.

Suggested Readings

1. Allen, W. M. (2007). *Data structures and algorithm analysis in C++*. India: Pearson ed.ucation.
2. Langsam, Y., Augenstein, M. J., & Tenenbaum, A. M. (2000). *Data Structures using C and C++* India: Prentice-Hall.

CE-315 **Data Structures and Algorithms (Lab)** **1 (0+1)**

The main aim of this lab is to acquaint students with basic data structures and the abstract data structures and user defined. data structures and their applications to represent various information types. Design and analysis of various algorithms for solving various searching, and sorting problems. It is designed. for students in engineering and other related. fields. It introduces students to different data structures available which can be used. in various algorithms. It allows students to analyze and choose appropriate data structure to the problems that may arise within the context. It also enables the students to analyze the time complexities of different algorithms with respect to the input size.

Contents

1. Introduction to Arrays
2. Searching and Sorting Algorithms
3. Introduction to Singly Linked. Lists.
4. Menu Driven Program for Singly Linked. Lists
5. Polynomial Evaluation using linked. lists
6. Introduction to doubly linked. lists
7. Menu driven program for doubly linked. lists
8. Infix to Postfix expression conversion
9. Postfix expression evaluation
10. Divide and conquer algorithms
11. Binary Search Trees
12. Heapsort
13. Merge sort

Recommended Texts

1. Course lab manuals
2. Lipschutz, S. (2009). *Data Structure with C*. India: Schaum Series.

Suggested Readings

1. Allen, W. M. (2007). *Data structures and algorithm analysis in C++*. India: Pearson ed.ucation.
2. Langsam, Y., Augenstein, M. J., & Tenenbaum, A. M. (2000). *Data Structures using C and C++*. India: Prentice-Hall.

EE-321 **Linear Control Systems** **4 (3+1)**

This course presents an introduction to feed.back control systems. Control systems have importance in all fields of engineering. The objective is to provide the student with the basic concepts of control theory as developed. over the years in both frequency and time domain. Through this course the student will also be able to learn about the Second order system which is enable them to troubleshoot error to uphold sensitivity and stability in the system. The theorical knowled.ge about the Linear Control system will go together with Lab work which will further enhance students grip onto the required. course.

Contents

1. Mathematical Modeling: Electrical, mechanical and electro-mechanical systems
2. Open loop vs closed. loop control
3. Block diagrams and signal flow graphs
4. Second Order Systems (Step and Impulse response, Performance criteria, steady state error, sensitivity and stability)
5. PID Control
6. The Root Locus Technique: Analysis and Design
7. Bode plots and Nyquist criterion (gain margins and phase margins)
8. The state space method (state equations, flow graphs, stability, compensation techniques)

Recommended Texts

1. Gene F.Franklin, J. D. Powell and A. Emami-Naeini (2019), *Feed.back Control of Dynamic Systems* (8^{th} ed.). New York: Pearson Inc.

Suggested Readings

1. R. C. Dorf and R. H. Bishop. (2011). *Modern control systems* (12^{th} ed.). New York: Pearson Inc
2. K. Ogata. (2010). *Modern Control Engineering* (5^{th} ed.). New York: Pearson Inc

EE-321 **Linear Control System (Lab)** **1 (0+1)**

Linear Control system is a core subject offered. in the Bachelor of Electrical engineering. The lab for this course is designed. to familiarize the students with the concept of control system analysis and design in time and frequency domain both by classical methods and modern techniques while working on MATLAB and Simulink. Firstly, students are familiarized. with the commands that are used. to produce specific behavior of the system, conversion of the system from time domain to frequency domain and vice versa. Analysis of the transient and steady state response, Stability of the control system, System type and steady state errors are accomplished. in MATLAB and run their respective models in Simulink. Root locus technique, which is further explored. in design of PD, PI and PID controllers are used. to analyze the system behavior. In the end of these labs a PID controller-based. project is assigned. to the students to acquire the skill of designing for real time problems.

Contents

1. A Brief Background of MATLAB and Analysis of First Order Electrical systems.
2. Mathematical Modeling of Physical Systems and Analysis of their Behavior using MATLAB/Simulink.
3. Transfer Function Through Block Red.uction and Analysis of Feed.back on the System Output.
4. Analysis of the Transient and Steady State Responses for the First and Second Order Systems.
5. Stability Analysis of Control System.
6. Modeling of Common Problems in Control Systems Using LTI.
7. Analysis of System Type and Steady State Errors.
8. Analysis of Root Locus Technique
9. Analysis of Integral Compensation (PI) and Lag Compensated. Systems.
10. Analysis of Derivative Compensation (PD) and Lead Compensated. Systems.
11. Analysis and Design of PID Controller
12. Analysis and Design of Frequency Domain Techniques.

Recommended Texts

1. Laszlo Keviczky. (2019) *Control Engineering: MATLAB Exercises* (1st ed.). New York City: Springer.
2. Katsuhiko Ogata. (2008). *MATLAB for Control Engineers*. (1st ed.). NJ: Prentice Hall.

Suggested Readings

1. Benjamin C. Kuo. (1962). *Automatic Control Systems* (9th Ed.). New Jersey: John Wiley & Sons

SOC-322 **Social Sciences-I** **3 (3+0)**

This course introduces contemporary and controversial ethical issues facing the business community. Topics include moral reasoning, moral dilemmas, law and morality, equity, justice and fairness, ethical standards, and moral development. Upon completion, students should be able to demonstrate an understanding of their moral responsibilities and obligations as members of the workforce and society. The main objective of this course is to apprise potential engineers about social factors that contribute towards enhancing their professional performance for the good of society and the country. This course is culture specific and must be taught within the context of local and national socio-economic environment.

Contents

1. Introduction to social science
2. An overview of business ethics
3. Ethical issues in business ethics
4. Applying moral philosophies to business ethics
5. Social responsibility
6. An ethical decision-making framework
7. How the organization influences ethical decision making
8. The role of opportunity and conflict
9. Development of an effective ethics program
10. International business ethics
11. Culture
12. Interpersonal relation
13. Social stratification
14. Community development

Recommended Texts

1. Allport, G. W. (1985). *The Historical Background of Modern Social Psychology*. New York: Random House.
2. Bernard, A. and T. Burgess. (2004). *Sociology*. UK: Cambridge University Press.

Suggested Readings

1. DuBrin, A. J. (2007). *Human Relations: Interpersonal Job Oriented. Skills.* NJ: Prentice Hall.
2. Gardezi, H. N., (1991*). Understanding Pakistan: The Colonial Factor in Societal Development*. Lahore: Maktaba Fikr-o-Danish.
3. Gardezi, H. N., Hafeez, S. (1991). *Changing Pakistan Society* (1st ed.). Karachi: Royal Book Company.

EE-323 **Communication Systems** **4 (3+1)**

This course is structured.as a senior-level design course emphasizing fundamental communication principles and the application of these principles to contemporary analogue and digital communication systems. Students learn basic concepts (both digital and analogue) associated. with information, coding, modulation, detection, and signal processing in the presence of noise. They apply these concepts to the design of contemporary communications, and digital telephony such as television, radio, wireless, mobile, and satellite communications.

Contents

1. Amplitude Modulation: Baseband and carrier communications
2. Double Sideband (DSB), Single Sideband (SSB), Vestigial Sideband (VSB)
3. Super heterodyne AM Receiver, Carrier Acquisition and Television.
4. Angle Modulation: Instantaneous frequency, Bandwidth of FM/PM
5. Generation of FM/PM, Demodulation of FM/PM.
6. Noise: Mathematical representation, Signal to Noise Ratio, Noise in AM, FM, and PM systems
7. Pulse Modulation: Sampling and Quantization, Pulse Amplitude Modulation, Pulse Position and Pulse width Modulation, Quantization Noise,
8. Signal to Quantization Noise Ratio,
9. Pulse code Modulation,
10. Delta Modulation,
11. Frequency Keying. Shift Keying,
12. Phase Shift

Recommended Texts

1. Simon Haykin. (2006). *Communication Systems.* Hoboken: John Wiley.
2. B. P. Lathi. (2018). *Modern Digital and Analog Communication Systems* (5th ed.). Oxford: Oxford University Press

ECON-324 Engineering Economics & Management 3 (3+0)

The main aim of the course is to create awareness amongst the students about the economic as well as managerial considerations involved. in engineering. Therefore, students not only understand engineering principles but also are able to manage the human resource in the workplace and act as a team player being part of a team. This subject helps the students to understand the need. for the knowled.ge of Economics for being an effective manager and decision maker. It offers wide opportunities in developing countries like Pakistan. Techniques like Cost and breakeven analysis especially deal with the various cost concepts and their practical usefulness in managerial decision-making. It plays an important role in profit planning. The success of a firm depends upon correct price decisions taken by it. Engineering economics poses numerous benefits because it allows those in industry to make strategic decisions for their companies. Moreover, they provide the foundation for engineers to make good decisions in the business environment.

Contents

1. Basic concepts and principles of Economics, Microeconomic theory, the problems of scarcity. Concept of Engineering Economy.
2. Goods and services, demand & supply concept. Equilibrium, elasticity, Perfect competition, monopoly, monopolistic competition and oligopoly
3. Basic accounting equation. Financial statements, Working capital management.
4. Break Even Analysis, Selection between alternatives and Time value of money.
5. Present value, future value and annuities, Cost-benefit analysis. Investment alternatives
6. Value analysis proced.ures. Value engineering proced.ures.
7. Mathematical statement of linear programming problems
8. Depreciation concept, economic life, methods of depreciation
9. Engineering management from science to engineering, Understanding behavior of people
10. Developing, organizing, managing engineering projects, principles of production, quality, reliability and safety, selling, using, and supporting engineering products.
11. Engineering in society, (TQM), organizational behavior and industrial psychology.

Recommended Texts

1. Samuelson, P. A., & Nordhaus, W. D. (2009). *Economics* (19th ed.). New York: McGraw-Hill/Irwin.
2. O'Connor, P. D. (2005). *The New Management of Engineering.* Stevenage: Lulu Press.

Suggested Readings

1. Tarquin, L. B. (2011). *Engineering economy* (7th ed.) New York: McGraw-Hill.
2. DeGarmo, E. P. (1997). *Engineering Economy* (10th ed.) N.J: Prentice Hall.

EE-325 **Renewable Energy Systems** **4 (3+1)**

Renewable energy usually attributed. to as clean energy, originates from natural sources that are continually replenished. While renewable energy is usually considered. as modern technology, harnessing nature's power has long been utilized. for heat transfer, solar (sunshine) energy, lighting, and likewise. This course provides an overview of important topics related. to renewable energy sources and their economic, environmental, and social impacts. Students will learn about the state of the art in renewable energy applications including the biomass for heat electric power and liquid fuels as well as geo-energy sources such as wind solar and hydropower. Students will do engineering calculations of power and energy availability of renewable energy sources and learn about the requirement for integrating renewable energy sources into production distribution and end-use systems.

Contents

1. Principles of renewable energy
2. Essential of fluid dynamics
3. Heat transfer
4. Solar radiation
5. Solar water heating
6. Solar thermal applications
7. Photovoltaic generation
8. Hydro power
9. Wind power
10. Photosynthetic process
11. Biomass and biofuels
12. Wave power
13. Tidal power
14. Ocean thermal energy conversion
15. Geothermal energy
16. Energy systems, storage and transmission
17. Institutional and economics factors

Recommended Texts

1. John Twidell and Tony Weir. (2005). *Renewable energy resources* (2nd ed.). USA: Taylor and Francis.

Suggested Readings

1. Engr. Prof. Dr. Suhail Aftab. Qureshi. (2019). *Smart Grid and Renewable Energy Resources (1st ed.). Pakistan: UET press.*
2. Gilbert M. Masters. (2013). *Renewable and Efficient Electric Power Systems* (2nd ed.). USA: Wiley-IEEE Press.

EE-325 **Renewable Energy Systems (Lab)** **1 (0+1)**

Renewable Energy Systems is the elective course in electrical engineering. Renewable energy Resources especially Solar and Wind energy are expected. to play a very significant role in the future especially in developing countries, but it also has potential in developed. countries. Its lab comprises the following Parts: First portion of this lab course introduces concepts of photovoltaic systems, solar panel sizing and battery sizing & their series and parallel combination. Second Portion introduces wind turbine systems, calculations of wind energy yield, capacity factor and land area requirements. Third portion introduces hydroelectricity, tidal, ocean current and wave energy generation systems. In this lab course, our main focus is to provide a comprehensive account of solar, wind energy modelling methods and calculations of hydro potential availability. For this purpose, explanatory material has been introduced. with MATLAB based. simulation models with the intention that students can benefit on the subject both from application and research points of view. In practical implementation, the efficiency of solar PV and wind energy conversion systems is less, hence converters are used. to improve the efficiency. Converters are designed. using MATLAB/SIMULINK models thus increasing the efficiency and providing several applications in the research perspective.

Contents

1. Familiarization with SIM Power system toolbox and its use for Renewable Energy system
2. Introduction and understanding the concept of PV Module Using MATLAB
3. Analyzing PV Array Set with Load and Vary Irradiance
4. Analyzing Boost Converter Design Using PV Array
5. Analyzing Buck Converter Design Using PV Array
6. Analyzing and Understanding the Working of Buck-Boost Converter with PV Array
7. Implementation of Maximum Power Point Tracking (MPPT) Algorithm Using MATLAB and Simulink
8. Analyzing the Shading Impact on PV System
9. To Study and Understand How To Calculate Solar Panel Efficiency, Power and Energy Capacity
10. To Study and Understand PV Panel and Battery Sizing
11. To Study and Understand Wind Turbine Power Characteristics
12. To Study and Identify Various Parameters of Wind Turbine
13. To Study and Understand the Working Principles of HydroElectricity and Tidal Energy Generation
14. To Study and Understand the Working Principles of Ocean current and Wave Energy Potential

Recommended Texts

1. Masters, G. M. (2013). *Renewable and efficient electric power systems* (2nd ed.). New Jersey: John Wiley & Sons.

Suggested Readings

1. Twidell, J., & Weir, T. (2015). *Renewable energy resources* (3rd ed.). Oxford shire: Routled.ge.
2. Da Rosa, A. V. (2009). *Fundamentals of renewable energy processes* (3rd ed.). Cambridge: Academic Press.

SOC-412 **Social Sciences-II** **2 (2+0)**

The main objective of this course is to apprise potential engineers about social factors that contribute towards enhancing their professional performance for the good of society and the country. This course is culture specific and has to be taught within the context of local and national socio-economic environment. The engineers are expected. to supervise several people in different capacities and their understanding about human behavior is critical for their optimum performance. Modification of human behavior or getting work done from subordinates and seniors remain a major challenge for all the professional engineers. This course will enhance understanding about the determinants of human behavior, which ultimately will result in improved. individual efficiency.

Contents

1. Human Ecology: Ecological Processes, Ecosystem and energy, Ecosystem and Physical Environment, Solid Waste Disposal, Pollution.
2. Population Dynamics: World Population Growth and Distribution, Population Dynamics in Pakistan, Causes and Consequences of Urbanization, Population Policy in Pakistan, Population and Development.
3. Community Development: Meaning, Scope, and Subject Matter of Community Development, Processes of Community Development, Community Development Programs in Pakistan, Community Organization and Related. Services, Cooperation and Conflict in Community Development.
4. Deviance and Crime: Crime as a Social and Cultural Phenomenon, Crime and Social Organization, Organized. Crime, Culture Based. Crime, Economics of Crime.
5. Sociology of Change and Development: What is Social Change and Development? Dynamics of Social Change, Role of NGOs in Development, World System and Development, Gender and Development.

Recommended Texts

1. Allport, G. W. (1985). *The Historical Background of Modern Social Psychology*. New York, Random House.
2. Bernard, A. and T. Burgess (2004). *Sociology*. Cambridge: Cambridge University Press.

Suggested Readings

1. DuBrin, A. J. (2007). *Human Relations: Interpersonal Job Oriented. Skills*. NJ: Prentice Hall.
2. Gardezi, H. N. (1991). *Understanding Pakistan: The Colonial Factor in Societal Development*. .Lahore, MaktabaFikr-o-Danish.

MS-413 Entrepreneurship 2 (2+0)

Entrepreneurship can broadly be defined. as the creation or extraction of value. With this definition, entrepreneurship is viewed. as change, which may include other values than simply economic ones. Some more narrow definitions has described. entrepreneurship as the process of designing, launching and running a new business, which is often initially a small business, or as the "capacity and willingness to develop, organize and manage a business venture along with any of its risks to make a profit."The people who create these businesses are often referred. to as entrepreneurs. While definitions of entrepreneurship typically focus on the launching and running of businesses, due to the high risks involved. in launching a start-up, a significant proportion of start-up businesses have to close due to "lack of funding, bad business decisions, an economic crisis, lack of market demand, or a combination of all of these. A somewhat broader definition of the term is sometimes used., especially in the field of economics. In this usage, an entrepreneur is an entity which has the ability to find and act upon opportunities to translate inventions or technologies into products and services: "The entrepreneur is able to recognize the commercial potential of the invention and organize the capital, talent, and other resources that turn an invention into a commercially viable innovation.

Contents

1. Introduction: Concept, economist view, sociologist view, Behavioral approach
2. Practice of Entrepreneurship: Process, Entrepreneurial Management, New venture.
3. Entrepreneurship and Innovation: Concepts, Importance, Sources, process, Risks
4. Developing Entrepreneur: Profile, Trait approach, Factors, environment
5. Entrepreneurship Organization: Team work, Organization, Motivation, Value system.
6. Entrepreneurship and SMES: Defining SMEs, Scope of SMEs, and Entrepreneurial, managers of SME, Financial and marketing problems of SMEs.
7. Entrepreneurial Marketing: Framework, Devising plan, strategies, Product quality and design.
8. Entrepreneurship and Economic Development: Role of entrepreneur, Employment creation and training, Ideas, knowled.ge and skill development, The Japanese experience.
9. Case Studies of Successful Entrepreneurs

Recommended Texts

3. Rober D. Hisrich and Michael P. P. (2010). *Entrepreneurship/lip* (5th ed.). NJ: McGraw Hill
4. Khanka S.S.(2009). *Entrepreneurial Development*. India: S. Chand and Company

Suggested Readings

2. Bruce A. Kirchhoff. (2006). *Entrepreneurship and Dynamic Capitalism*. California: Stanford University Press.
3. Irving B. (2010). The small Businesses Handbook. UK: Simon & Schuster.

EE-415 **Power Distribution & Utilization** **4 (3+1)**

The main aim of this course is to study theory and the concept of electrical power distribution and utilization. This course introduces basic concepts of relationship of level of voltages and other physical parameters for electrical power distribution. This course also covers the effective and efficient utilization of electrical energy. However, a large amount of power is lost due to inefficient utilization. This course will enable students to understand the basics of power distribution as well as analyzing the factors and parameters affecting efficient and reliable utilization of electrical power.

Contents

1. Introduction; Urban, Sub-Urban, Rural Distribution, Voltage Levels
2. Distribution System; Types of Distributors, Radial, Ring and Interconnected.
3. Distribution Transformers; Applications of Distribution Transformers
4. Variable Load; Estimation, Properties of Load, Voltage Regulations
5. Substation Systems; Switchgear Systems, Bus Bar arrangements
6. Power Factor; Causes of Low P.F, Improvement Methods
7. Grounding and Earthing; Neutral Grounding, Equipment Grounding, and System Grounding
8. Electrical Welding; Resistance Welding, Arc Welding
9. Electrical Heating; Dielectric Heating, Inductance Heating, Electric Furnaces, Microwave Heating
10. Electrochemical Processes; Electroplating, Electrolysis, Electro-Metallurgical process
11. Electrical Illumination; Laws, Units, Street Lighting, Traffic Lighting, Flood Lighting
12. Lamps and Bulbs; Types, Working and relative merits
13. Batteries; Types, Working and Charging of Batteries

Recommended Texts

1. V. K. Mehta. (1999). *Principles of Power Systems* (Latest ed.). Delhi: S. Chand and Co Ltd.
2. J. B. Gupta. (2009). *A course in Power Systems* (Latest ed.). India: S. K. Kataria and Sons.

Suggested Readings

1. Turen Gonen. (2008). *Electrical Power Distribution Systems* (2nd ed.). Boca Raton: Taylor & Francis.
2. Subir Ray. (2014). *Electrical Power System; Theory, Concepts, Practice* (2nd ed.). India: PHI Learning.

ET-415 Power Distribution and Utilization (Lab) 1 (0+1)

The Power Distribution & Utilization Laboratory is well-known in the various fields of engineering applications due to its significance. For an electrical engineer, it is required. to gain a hand on experience of practical implementation of the power distribution & utilization. By this take, laboratory manuals based. on implementation, observation and analysis have been introduced. for power distribution & utilization laboratory.

Contents

1. An orientation of electrical safety and precautions
2. An orientation to power distribution & utilization trainer
3. Familiarization of feed.er and distribution system
4. Familiarization of coupler panel connections and its applications
5. Analyzing the load characteristics using energy analyzer
6. Analyzing load characteristics using feed.er 1 and feed.er 2
7. Analyzing load characteristics using feed.er 2 and feed.er 3
8. Performing distribution, its connections and different phases
9. To perform energy analyzer connections and study of load by using different combinations of connections
10. To perform and analyze residential electrical wiring
11. Study of series and parallel connections of load in distribution box
12. Investigate the load measurements
13. Investigation and analysis of University of Sargodha Distribution system

Recommended Texts

1. *Power Distribution & Utilization Lab Manual.*

Suggested Readings

1. *Power Distribution & Utilization Lab Manual.*

EE-416 Power Generation 4 (3+1)

This course is to learn about different generating power plants as Hydro-electric, wind, thermal, gas, solar thermal, nuclear plants and geothermal. The course will also focus on the comparison between different generating power plants according to their running and fixed. costs, their typical ramp, economics and electrical loads in power systems, environmental impacts of power generation and will look at alternative and sustainable generation systems. Having completed. this course the students will be able to describe what role hydroelectricity play in today's power engineering market. In addition to this they will also be to describe the difference between different power generating units.

Contents

1. World Energy Situation and Energy Resources in Pakistan
2. Methods of Energy Conversion
3. Development of Energy resources
4. Environmental Issues of Power Generation
5. Relative cost of Various Power Plant
6. Economics and electrical load in Power Generation
7. Working Principle of Thermal Power Generation
8. Design and General Layout of Thermal Power Plant
9. Efficiency and Cost of Thermal Power Generation
10. Design and Operation of Gas Turbine Power Plant
11. Efficiency and Cost of Gas Turbine Power Plant
12. Working Principle of Hydro-Electric Power Plant
13. Hydraulic issues of Hydro-Electric Power Plant
14. Design and Layout of Hydro-electric Power Plant
15. Review of Nuclear Physics
16. Working principle of Nuclear power stations
17. Comparison of Nuclear with other power stations
18. Design of Nuclear power stations
19. Layout of Nuclear power stations
20. Safety issues in Nuclear power stations
21. Control system of radioactive waste
22. Introduction to diesel electric power station
23. Design of diesel power station
24. Introduction to renewable energy sources
25. Wind power plant
26. Solar power plant
27. Thermoelectric and MHD power plant
28. Fuel Cells: Principles, efficiency, performance, design and new development

Recommended Texts

1. Arche W. Culp, P.E. (1991). *Principles of Energy Conversion* (3rd ed.). NJ: McGraw-Hill.

Suggested Readings

1. Prof. Dr. M. N. Arbab (2013). *Power Generation* (1st ed.). Peshawar: Afaaq Publishers

EE-416 **Power Generation (Lab)** **1 (0+1)**

Through this lab work theocratical knowled.ge of Power generation will be placed. under test to harvest its practical utility. The students will be introduced. to the process techniques for electricity and heat generation and to various measurement and arrangement of energy balances and characteristic curves which will further enhance their understanding about the energy generation. Having completed. this course, they will be able analyze different technical criteria for energetic assessment of process control such as steam turbine process, lamp measurement, combined. heat and power, fuel cell etc.

Contents:

1. Electrical Safety & Precaution
2. Introduction to Power Generation Trainer
3. Familiarization of Energy Analyzer Functionality with Load
4. Understand Basics of Power Generation
5. Investigate Voltage Regulation by Direct Method
6. Analyse Regulation of Alternator by Open Circuit and Short Circuit Test
7. Investigate Slip Test for the Measurement of Synchronous Machine Constants
8. Find out Characteristics of Resistive, Capacitive and Inductive Load with Generator Trainer
9. Analysing the Synchronization by Two Bright and One Dark Lamp Method
10. To Check the Working of Synchroscope
11. Familiarization with Synchronization of Two Parallel Systems by Dark Lamp Method
12. Determine the Working of Three Phase Watt Meter
13. Working Of Tachometer in Order to Measure Rpm of Synchronous Generator.

Recommended. Texts

1. *Power Generation Lab Manual*
2.

Suggested Readings

1. *Power Generation Lab Manual*

EE-422 **Electrical Power Transmission** **4 (3+1)**

The main aim of this course is to study theory and the concept of electrical power transmission. This course introduces basic concepts of relationship of level of voltages and other physical parameters for electrical power transmission. This course also covers the factors (Electrical and environmental) which, curb the amount of electrical power being transmitted. Transmission of electrical energy is an inevitable phenomenon. However, a large amount of power is lost due to number of factors. This course will enable students to understand the basics of power transmission as well as analyzing the factors and parameters affecting efficient and reliable flow of power.

Contents

1. Introduction; Level of transmission and types, voltages for transmission in Pakistan and world
2. Basic electrical power system concepts; Node equations, One-Line diagram, Per-Unit System
3. Conductors; materials, types and properties of different types of conductors
4. Transmission Line Parameters; Resistance, Skin Effect, Proximity Effect, Inductance
5. Transmission Line Parameters; Conductance, Capacitance, Ferranti Effect
6. Effect of earth; Effect of earth on the capacitance of overhead transmission line
7. Power Flow; Voltage regulation, surge imped.ance loading, lightening strokes and transients
8. Mechanical Design; Support structure, insulators, sag and tension, wind and ice loading
9. Insulators; Materials, Types of insulators, voltage distribution across string, string efficiency
10. Corona Effect; Formation of corona, loss, radio interference
11. HVDC; Introduction to DC transmission, configurations, pros and cons
12. Underground Power Transmission; Cables
13. Cables; types, faults, techniques to locate faults, and remed.y to fault removals

Recommended Texts

1. Grainger, and Stevenson. (1994). *Power System Analysis* (Int. ed.). UK: Mc Graw Hill Ed.ucation.
2. V. K. Mehta. (1999). *Principles of Power Systems*. Delhi: S. Chand and Co Ltd.

Suggested Readings

1. Turen Gonen. (2009). *Electrical Power Transmission System Engineering—Analysis & Design* (2nd ed.). Boca Raton: Taylor & Francis.
2. Subir Ray. (2014). *Electrical Power System; Theory, Concepts, Practice* (2nd ed.). India: PHI Learning.

EE-422 Electrical Power Transmission (Lab) 1 (0+1)

The purpose of this lab workout is to develop a practical understanding of the Electrical Power Transmission System that holds a position of backbone in Electrical Network. Experiments are performed. on Transmission trainer that represents Short, Med.ium and Long transmission line models. Transmission line parameters including Line Resistance, Line Conductance and Line Capacitance are measured. At the same time experiments are performed. to calculate voltage regulation of different lengths of transmission lines. Having completed. this course the students will be able to apply their knowled.ge of Electrical Power Transmission into action.

Contents

1. Familiarization with Energy Analyzer and introduction to the transmission line trainer
2. Familiarization and calculation of transmission line parameters
3. To understand the construction, characteristics and applications of different types of insulators.
4. To Analyze the effect of Resistance on the transmission line
5. To Analyze the effect of inductance on the transmission line
6. To Analyze the effect of capacitance on the transmission line
7. To Calculate the flow of active and reactive power in 3-Phase transmission line at known load
8. To Calculate Voltage regulation of transmission line as a function of the type of Load
9. To understand the construction and technical specifications of different types of OHL conductors
10. To understand main supporting units of OHTL (Transmission Towers)
11. To understand the construction, characteristics, selection and application of Lightning arrestors
12. To Analyze the connection of transmission line with 3 phase feed.er
13. To understand vibration damper and its types used. in transmission line
14. To learn about different types of underground cables

Recommended Texts

1. Grainger, and Stevenson. (1994). *Power System Analysis*. (Int. ed.). UK: Mc Graw Hill Ed.ucation.
2. V. K. Mehta. (1999). *Principles of Power Systems*. Delhi: S. Chand and Co Ltd.

Suggested Readings

1. Turen Gonen. (2009). *Electrical Power Transmission System Engineering—Analysis & Design* (2^{nd} ed.) Boca Raton: Taylor & Francis.
2. Subir Ray. (2014). *Electrical Power System; Theory, Concepts, Practice* (2^{nd} ed.). India: PHI Learning.

EE-423 | High Voltage Engineering | 4 (3+1)

This course is intended. to provide a basic introduction to the theory of High voltage circuits linked. with operation and characteristics of the liquid, gaseous and solid materials. The students should be introduced. to high voltage generation, measurement, transient and insulation breakdown. For the student this course represents the first contact with the diverse subject of high voltage engineering. It mainly aims at: i) introducing fundamental concepts and providing basic understanding within the area of classical experimental high voltage engineering; ii) familiarizing the student with the electric power system on a component level and iii) preparing the student for the second course High Voltage Technology which is essential for the student wishing to achieve a broader and deeper understanding of the subject. After successful completion of the two courses in high voltage engineering as a part of the electric power program the student is well prepared. for a carrier e.g. as a R&D-engineer of high voltage design and laboratory activities or as a qualified. engineer dealing with various aspects of the components in the power system.

Contents

1. Importance of high voltage on all fields of daily life and med.ical application.
2. Dielectric Strength of solids, liquid and gases Breakdown of solids liquids and gases (Townsend and streamer Breakdown).
3. Breakdown of unstable states of matter, Role of high voltage in production of unstable states of matter.
4. Transformers, Series and cascaded. connections, Bracketing in Transformers and its purpose.
5. Sries and Parallel Resonant Transformer, Tesla Coil, Transformer with Rectifier, Voltage Multiplier, Deltatron Multiplier.
6. Electrostatic Voltage Generators (Van de Graff Generator, SAMe's Generator, Kelvin Water dropper, Whimshurst Machine)
7. Introduction of Impulse, Standard Impulse used. for testing Construction and working of MARX and Good-Let Generators for impulses, Impulse Current Generators.
8. Direct and Indirect Measurement of high Voltages and its significance in a particular situation.
9. Direct Measurement: HV probe, Potential Transformer, Ammeter in series with high resistance Voltage divider.
10. Spark gaps, Electrostatic & Electrodynamic Voltmeter, Hall Effect Sensor, Electro Optical Measurement
11. Grounding, Touch and step potential in HV.
12. Leakage current, types and components, Method of measuring and minimizing leakage current.
13. Different types of polymeric and ceramic.
14. Tests: Destructive, non-destructive, routine, fatigue, quantitative and qualitative etc
15. Scope trends technologies and future of HVDC, Advantages, issues in HVDC systems.
16. HVDC distribution Systems and its applications.

Recommended Texts

1. Y. Kuffel, J. Kuffel and W. S. Zaingi. (1984). *High Voltage Engineering* (2nd Ed.). UK: Butterworth Heinemann.

Suggested Readings

1. Muhammad Naeem Arbab, (2013), *High Voltage Engineering* (1st ed.). Peshawar: Afaq Printers.

EE-423 **High Voltage Engineering (Lab)** **1 (0+1)**

The High Voltage Engineering Laboratory is well-known in the various fields of engineering applications due to its significance. For an Electrical Engineer, it is required. to gain a hand on experience of practical implementation of the High Voltage Engineering. By this take, laboratory manuals based. on implementation, observations and, analysis have been introduced. for High Voltage Engineering Laboratory. At the end of the course, students should be able to recognize the usage of control desk, testing transformer, safety precautions and analytical system tool, assemble and examine high voltage, impulse voltage generation and measurement of performance and express knowled.ge and analysis of Disruptive discharge voltage.

Contents

1. Generation and measurement of AC voltage.
2. Generation and measurement of AC voltage through oscilloscope.
3. Generation and measurement of AC voltage through sphere gaps.
4. Understand Generation and measurement of DC voltage.
5. Generation and measurement of DC voltage.
6. Voltage doubler circuit.
7. Polarity effect and insulation screen.
8. Generation and measurement of impulse voltage.
9. Generation and measurement of impulse voltage using trigger sphere gap.
10. Disruptive discharge voltage tests with alternating current.
11. Disruptive discharge voltage tests with direct current.
12. Lighting impulse disruptive discharge test.
13. Insulation test for transformer oil.

Recommended Texts

1. Y. Kuffel, J. Kuffel and W. S. Zaingi, *High Voltage Engineering* (2nd Ed.). UK: Butterworth Heinemann.

Suggested Readings

1. Muhammad Naeem Arbab, (2013), *High Voltage Engineering* (1st ed.). Peshawer: Afaq Printers.

COURSE OUTLINE BRIEFS

DEPARTMENT OF TECHNICAL EDUCATION

SARGODHA UNIVERSITY
Pathway to Progress

FACULTY OF ENGINEERING AND TECHNOLOGY

OVERVIEW

The global economic order, the rapid rate of technological advancement, the information revolution and rapid urbanization process have opened new series of challenges as well as opportunities. The ability to innovate and the capacity to adapt to latest technologies are going to be the forte in the new century. In this scenario, Technical Education plays a vital role. It helps developing human resource by creating skilled manpower, increasing industrial productivity and improving the quality of life.

The Department of Technical Education, established in 2013, aims at the academic and vocational preparation of students for jobs involving applied science and modern technology. It offers BS-Program in Civil, Electrical and Mechanical areas while its first session passed out in 2017. The main emphasis of the Department is to produce technically trained manpower in the context of rapid urbanization process in the country.

Our experienced and qualified faculty is struggling hard to produce best quality graduates and to offer a variety of post basic trainings that support the national human resource developments needs of industry.

BS Civil Engineering Technology

Eligibility: DAE/Equivalent (Minimum 50% marks)
Duration: 4 Years
Semesters: 8
Degree Requirements: Minimum 130 cred.it hours

Semester-1

Course Code	Course	Credit Hours	Contact Hours
MATH-111	Applied. Mathematics-I	3(3+0)	3
CS-112	Computer Applications	2(1+1)	4
ENG-113	Communication Skills-I	3(3+0)	3
CT-114	Civil Engineering Drawing	3(1+2)	7
CT-115	Materials and Methods of Construction	3(3+0)	3

Semester-2

Course Code	Course	Credit Hours	Contact Hours
CT-121	Applied. Mechanics	4(3+1)	6
MATH-122	Applied. Mathematics-II	3(3+0)	3
ENG-123	Communication Skills-II	2(2+0)	2
CT-124	Concrete Technology	4(3+1)	6
CT-125	Surveying	4(2+2)	8

Semester-3

Course Code	Course	Cred.it Hours	Contact Hours
MATH-211	Applied. Mathematics-III	3(3+0)	3
CT-212	Hydrology	4(3+1)	6
CT-213	Fluid Mechanics	4(3+1)	6
CT-214	Mechanics of Materials	4(3+1)	6
CT-215	Engineering Geology	2(2+0)	**2**

Semester-4

Course Code	Course	Credit Hours	Contact Hours
CT-221	Soil Mechanics	4(3+1)	6
CT-222	Highway and Transportation Engineering	4(3+1)	6
CT-223	Quantity Surveying and Contract Document	3(3+0)	3
CT-224	Material Testing Repair and Maintenance	2(2+0)	2
MS-225	Total Quality Management	2(2+0)	2
CT-226	Theory of Structures	4(3+1)	6

Semester-5

Course Code	Course	Credit Hours	Contact Hours
CT-311	Irrigation and Hydraulic Engineering	4(3+1)	6
CT-312	Reinforced Concrete Structures	4(3+1)	6
CT-313	Steel Structures	3(3+0)	3
CT-314	Computer Aided. Building Modeling & Design	2(2+1)	5
CT-315	Water Supply & Waste Water Management	4(3+1)	6

Semester-6

Course Code	Course	Credit Hours	Contact Hours
CT-321	Environmental Management	4(3+1)	6
CT-322	Introduction to Earth Quake Engineering	3(2+1)	**5**
MS-323	Project Management	3(3+0)	**3**
PK. ST-325	Pakistan Studies	2(2+0)	2
CT-326	Project	3(0+3)	9

Semester-7

Course Code	Course	Credit Hours	Contact Hours
ISL-411	Islamic Studies	2(2+0)	2
CT-412	Foundations and Pavements	4(3+1)	6
SOC-413	Social Sciences	3(3+0)	3
CT-414	Project	3(0+3)	9

Semester-8

Course Code	Course	Credit Hours	Contact Hours
CT-421	Supervised. Industrial Training	18(0+18)	36

BS Electrical Engineering Technology

Eligibility: DAE/Equivalent (Minimum 50% marks)
Duration: 4 Years
Semesters: 8
Degree Requirements: Minimum 130 cred.it hours

Semester-1

Course Code	Course	Cred.it Hours	Contact Hours
MATH-111	Applied. Mathematics-I	3(3+0)	3
CS-112	Computer Applications	2(1+1)	4
ENG-113	Communication Skills-I	3(3+0)	3
ET-114	Applied. Physics	4(3+1)	6
ET-115	Engineering Drawing	2(1+1)	4
ISL-116	Islamic Studies	2(2+0)	2

Semester-2

Course Code	Course	Cred.it Hours	Contact Hours
ET-121	Basic Electronics	4(3+1)	6
MATH-122	Applied. Mathematics-II	3(3+0)	3
ENG-123	Communication Skills-II	2(2+0)	2
ET-124	Linear Circuit Analysis	4(3+1)	6
ET-125	Basic Mechanical Technology	4(3+1)	6

Semester-3

Course Code	Course	Cred.it Hours	Contact Hours
MATH-211	Applied. Mathematics-III	3(3+0)	3
ET-212	Network Analysis	4(3+1)	6
ET-213	Digital Electronics	4(3+1)	6
ET-214	Power Generation and Utilization	4(3+1)	6
ET-215	Electrical Machines-I	4(3+1)	6

Semester-4

Course Code	Course	Credit Hours	Contact Hours
ET-221	Instrumentation and Measurement	4(3+1)	6
ET-222	Electrical Machines-II	4(3+1)	6
ET-223	Power Transmission	4(3+1)	6
ET-224	Data and Computer Communication	4(3+1)	6
MS-225	Total Quality Management	2(2+0)	2

Semester-5

Course Code	Course	Credit Hours	Contact Hours
ET-311	Microprocessor Theory and Interfacing	4(3+1)	6
ET-312	Power and Industrial Electronics	4(3+1)	6
ET-313	Switchgear and Protective Devices	4(3+1)	6
ET-314	Tele-Communication Technology	4(3+1)	6
ET-315	Industrial and Environmental Safety	2(2+0)	2

Semester-6

Course Code	Course	Credit Hours	Contact Hours
ET-321	Power System Protection	4(3+1)	6
ET-322	Control Technology	4(3+1)	6
ET-323	High Voltage Technology	4(3+1)	6
ET-324	Power Distribution and Utilization	3(2+1)	5
PK. ST-325	Pakistan Studies	2(2+0)	2

Semester-7

Course Code	Course	Credit Hours	Contact Hours
ET-421	Supervised. Industrial Training	16(0+16)	40

Semester-8

Course Code	Course	Credit Hours	Contact Hours
ET-421	Supervised. Industrial Training	16(0+16)	40

BS Mechanical Engineering Technology

Eligibility: DAE/Equivalent (Minimum 50% marks)
Duration: 4 Years
Semesters: 8
Degree Requirements: Minimum 130 cred.it hours

Semester-1

Course Code	Course	Credit Hours	Contact Hours
MATH-111	Applied. Mathematics-I	3(3+0)	3
CS-112	Computer Applications	2(1+1)	3
ENG-113	Communication Skills-I	3(3+0)	3
MT-114	Applied. Physics	4(3+1)	5
MT-115	Engineering Drawing	3(1+2)	5
ISL-116	Islamic Studies	2(2+0)	2

Semester-2

Course Code	Course	Credit Hours	Contact Hours
MT-121	Machining Processes	3(1+2)	5
MATH-122	Applied. Mathematics-II	3(3+0)	3
ENG-123	Communication Skills-II	3(3+0)	3
MT-124	Industrial Materials	3(3+0)	3
MT-125	Applied. Mechanics	4(3+1)	5
MT-126	Computer Aided. Drafting	2(1+1)	3

Semester-3

Course Code	Course	Credit Hours	Contact Hours
MT-211	Mechanics of Materials	4(3+1)	5
MATH-211	Applied. Mathematics-III	3(3+0)	3
MT-212	Applied. Thermodynamics	4(3+1)	5
MT-213	Production Planning and Control	3(3+0)	3
MT-214	Basic Electrical Technology	4(3+1)	5

Semester-4

Course Code	Course	Credit Hours	Contact Hours
MT-221	Machine Design	4(3+1)	5
MT-222	Industrial and Environmental Safety	2(2+0)	2
MT-223	Manufacturing Process	4(2+2)	6
MT-224	Fluid Mechanics	4(3+1)	5
MS-225	Total Quality Management	2(2+0)	2

Semester-5

Course Code	Course	Credit Hours	Contact Hours
MT-311	I.C Engine	4(3+1)	5
MT-312	Plant Maintenance	2(2+0)	2
MT-313	Mechanical Vibrations	4(3+1)	5
MT-314	Instrumentation and Control	4(3+1)	5
MT-315	Production Automation	4(3+1)	5

Semester-6

Course Code	Course	Credit Hours	Contact Hours
MT-321	Material Handling	2(2+0)	2
MT-322	Renewable Energy & Environmental Technology	4(3+1)	5
MT-323	Metrology & Gauging	3(2+1)	4
MT-324	Refrigeration and Air Conditioning	4(3+1)	5
PK. ST.-325	Pakistan Studies	2(2+0)	2
MT-326	Project Management	3(3+0)	3

Semester-7

Course Code	Course	Credit Hours	Contact Hours
MT-421	Supervised. Industrial Training	16(0+16)	32

Semester-8

Course Code	Course	Credit Hours	Contact hours
MT-421	Supervised. Industrial Training	16(0+16)	32

BS
CIVIL ENGINEERING TECHNOLOGY

MATH-111 **Applied. Mathematics-I** **3 (3+0)**

This course is designed. to ensure you have the working knowled.ge for problem-solving in non-calculus areas to support topics in science and engineering. You will explore measurement and calculation; vector and matrix methods; geometry and trigonometry; and the algebra and graphing of linear, quadratic, exponential and logarithmic functions to model problems in context. Your skills in the recall, use and communication of the mathematics presented. in this course provide the foundation for further studies in mathematics. The course is designed. to understand the concept and use of differential equations. The course includes an introduction to exponential and logarithmic functions, limits, derivatives, maxima/minima, and Lagrange multipliers, and applications from business, economics, and finance. Problem-solving with mathematical software will also be emphasized. This course also covers the hyperbolic and trigonometric identities and their relationship, Rectangular and polar co-ordinate systems in three dimensions, Divergence and the calculation for curl of a vector Field.

Contents

1. Real numbers and real line, Functions and their graphs, Rate of change and limits.
2. Differential Calculus: The derivatives as a function, Differential Rules, The derivative as a rate of change, Derivatives of algebraic functions, Derivatives of exponential functions, Derivatives of trigonometric functions, The chain rule and parametric equations, Implicit differentiation, Inverse functions and their derivatives, Derivatives of inverse trigonometric functions, Derivatives of hyperbolic functions, Findings of horizontal and normal tangents, Extreme values of functions, The mean value theorem.
3. Integral Calculus: Basic integration formulas, Integration by parts, Indefinite integrals and the substitution rule, Integration of rational functions by partial fractions, Improper integrals, The definite integral, Substitution and area between curves, Volume by slicing and rotation about an axis, Volume by cylindrical shells, length of plane curves, Area of surface of revolution.
4. Complex numbers, addition, multiplication, subtraction and division of complex numbers and complex plane.

Recommended Texts

1. Thomas, G. B. and Finney R. L. (2013). *Calculus and Analytic Geometry* (13th Ed.):Addison Wesley
2. Kreyszig, E. (2008) *Advanced. Engineering Mathematics* (10th Ed.). USA: John Wiley and Sons

Suggested Readings

1. Cohen, H. L.(2010). *Mathematics for Scientists and Engineers.*UK: Prentice-Hall

CS-112 Computer Applications 2 (1+1)

The purpose of this course is to enable students to comprehend fundamentals of computer essentials. Covers computer concepts and internet skills, and uses a software suite which includes word processing, spreadsheet, database, and presentation software to demonstrate skills. This course provides a foundation in information technology concepts, operating system functions and computer applications. Covers the basics of computer hardware, software, and networking and helps students develop basic skills in using Windows and Microsoft Office and creating web pages. Students also learn how to use computers safely, and to consider ethical issues related. to computer usage. Application of CAD to the development of structural and architectural drawings, dimensioning, grading plans, contour lines and sections. Analysis and design of structural systems using structural engineering packages. Development of algorithms and computer codes (MATLAB) for the solution of civil engineering problems. This subject also covers basic concepts of major building blocks their function and interconnections.

Contents

1. Basic Computer Organization: Major building blocks; their functions & inter connections.
2. Number Systems: Number conversion, Data Representation & Data structure. Processed. operation, Memory & I/O of a computer
3. Languages: High level & Low Level Languages, Compilers interpreters, operating systems, computer programming.
4. Application Packages: Word processors, Data Bases, Spread Sheets.
5. Computer Networking Fundamentals
6. Introduction to CAD: structural drawings
7. Introduction to MATLAB

Recommended Texts

1. Parker, C. S. and Morley, D. (2016) Understanding *Computers: Today and Tomorrow* (16th Ed.): Cengage Learning
2. Tucker, A. B. (2008). *Fundamentals of Computing.* New York: McGraw Hill
3. Moore, H. (2017). *MATLAB for Engineers*: Pearson.

Suggested Readings

1. Tucker A. B., Bernat A., Cupper R. D. and Scragg G. W. (2008). *Fundamentals of Computing.* New York: McGraw Hill

CS-112 **Computer Applications LAB** **2 (1+1)**

The purpose of this lab is to enable students to comprehend fundamentals of computer essentials. Covers computer concepts and internet skills, and uses a software suite which includes word processing, spreadsheet, database, and presentation software to demonstrate skills. This course provides a foundation in information technology concepts, operating system functions and computer applications. Covers the basics of computer hardware, software, and networking and helps students develop basic skills in using Windows and Microsoft Office and creating web pages. Students also learn how to use computers safely, and to consider ethical issues related. to computer usage. Application of CAD to the development of structural and architectural drawings, dimensioning, grading plans, contour lines and sections. Analysis and design of structural systems using structural engineering packages. Development of algorithms and computer codes (MATLAB) for the solution of civil engineering problems. This subject also covers basic concepts of major building blocks their function and interconnections.

Contents

1. Basic programming principles
2. Variables, Data Types and Subroutines
3. Crude Graphic User Interface (Form)
4. Matlab as computing engine: General functionality
5. Scalar and array operations
6. Plot capabilities: Scripts
7. Decisions and Loops in Programming

Recommended Texts

1. Parker, C. S. and Morley, D. (2016) Understanding *Computers: Today and Tomorrow* (16th Ed.): Cengage Learning
2. Tucker, A. B. (2008). *Fundamentals of Computing.* New York: McGraw Hill
3. Moore, H. (2017). *MATLAB for Engineers*. UK: Pearson.

Suggested Readings

1. Tucker A. B., Bernat A., Cupper R. D. and Scragg G. W. (2008). *Fundamentals of Computing.* New York: McGraw Hill

ENG-113 **Communication Skills-I** **3 (3+0)**

English is the language of science, of aviation, computers, diplomacy, and tourism. It's also the language of international communication, med.ia and the internet, so learning English is important for socializing and entertainment as well as work. The main aim of the subject is to increase the reading, writing and listening skills of the students. The ability to fluently speak English in addition to your native language can be beneficial if you're seeking job opportunities with international companies. To inculcate in students the skills of organizing material, writing a report, and presenting their work for business communication. Business communication is the process of sharing information between people within and outside a company. Effective business communication is how employees and management interact to reach organizational goals. Its purpose is to improve organizational practices and red.uce errors. Business communication is used. to promote a product, service, or organization; to relay information within the business; or to deal with legal and similar issues.

Contents

1. Introduction to Communication: Importance, Theories, Barriers, Components. The Seven C's for Effective Communication
2. Giving Feed.back. Reading Skills: Active Reading Techniques, Skimming,
3. General Reading and Careful Reading. Introduction to Writing Skills: Planning,
4. Drafting and ed.iting Emphasis and Connection
5. Grammar and Vocabulary: Technical and Business Vocabulary,
6. Constructing Formal Sentences

Recommended Texts

1. Murphy H. A., Hildebrandt H. W. and Thomas J.P. (1997) *Effective Business Communications* (7th Ed.). New York: McGraw-Hill
2. Norman, S. (1983). *We're in Business*. UK: Longman Group Ltd

Suggested Readings

1. Thomson, A. J. and Martinet, A. V. *A Practical English Grammar*. UK: *Oxford University Press*

CT-114 Civil Engineering Drawing 3 (1+2)

Drawing is an art of representing objects or forms on a surface chiefly by means of lines, using any of the wide variety of tools and techniques. It is also called. the language of engineers. It generally involves making marks on a surface by moving pencil, ink pen, wax color pencils or any marker on a plane surface such as paper, canvas etc. Drawings represent red.uced. shape of structure. An engineer must be well conversant with drawings. The aim of this course is to teach students to communicate using graphic techniques. This involves learning to "read" or interpret the information contained. in a 2D engineering drawing. After the completion of this course the student will be able to understand the basics of engineering drawing and able to prepare and understand engineering drawings. It also focuses to provide the students with knowled.ge of principles and techniques of manual construction drawing. They will be able to construct the structures at the site properly.

Contents

1. Descriptive Geometry: Lines in space and in planes showing their traces and true inclination to planes of projection, Plane curves, Cycloids, Hypocycloid, Involute, Curves of interpenetration of solids
2. Development of surfaces, Isometric views, Shadows.
3. Machine Drawing: Representation of riveted. joints, Screwed. fastenings, Keys and cotters, Preparation of fully dimensioned. working drawing of component parts of machines, Practice in reading of drawing and ded.uction of new views
4. Building Drawing: Introduction to architectural and structural drawings of simple buildings
5. Symbols and Abbreviations: Building materials; Electric and plumbing symbols and abbreviations

Recommended Texts

1. Siddiqi, Z. A. (2016). *Basics of Engineering Drawing*. Pakistan: M/S Technical Publishers

Suggested Readings

1. Horchsel, R. P. (2002). *Engineering Drawing and Geometry*. (2nd Ed.). New York: John Willy & Sons

CT-114 **Civil Engineering Drawing LAB** **3 (1+2)**

In civil engineering discipline, the engineer or designer working on a specific project must be able to communicate his or her design requirements to the contractor who is going to build the structure. The most effective way for a contractor or designer to produce set of drawings which clearly and unambiguously set out the structure. The drawing is the language of an engineer expressed. by the line. The shape intensity and texture are the alphabets of the drawing language. The aim of this lab is to practice the students about conversion of 3D objects to 2D drawings and the development of 3D object by using 2D drawings. They also practice providing all the necessary information like lettering dimension etc in an appropriate way. After the completion of this lab the students will be able to understand and interpret the information provided. in 2D drawing. It also focuses to provide the students with knowled.ge of principles and techniques of manual construction drawing. They will be able to construct the structures at the site properly.

Contents

1. Gothic lettering,
2. Curves
3. Polygons
4. Orthographic views (first and third angles)
5. Isometric views,
6. Sectional views
7. Plumbing, sanitation, HVAC symbols
8. Architectural plan, elevation, and section of a simple building
9. Architectural details of a boundary wall
10. Architectural details of staircase

Recommended Texts

1. Siddiqi, Z. A. (2016). *Basics of Engineering Drawing*. Pakistan: M/S Technical Publishers

Suggested Readings

1. Horchsel, R. P. (2002). *Engineering Drawing and Geometry* (2^{nd} Ed.). New York: John Willy & Sons

CT-115 Materials and Methods of Construction 3 (3+0)

This course explains why construction materials behave the way they do. It covers the construction materials content for undergraduate courses in civil engineering technology and related. subjects and serves as a valuable reference for professionals working in the construction industry. This subject only gives a brief description about different types of materials used. in building construction for members like foundation, masonry, arches, lintels, balcony, roof, floor, doors, windows, stairs, plastering, painting and other general topics. Properties of various construction materials, their uses and different applications are discussed. in this subject. It provides information about all the building materials generally used. its types, properties and uses. Most of these structures are large in scale such as bridges, buildings, and dams. Materials that are widely used. in the civil engineering technology practice include reinforced. concrete, asphalt, masonry, wood, structural steel, aluminum, and polymers.

Contents

1. Bricks, Blocks and Tiles: Manufacture of bricks and blocks and its classifications, standard tests of bricks and blocks and characteristics of good bricks and blocks, process of manufacture of tiles.
2. Stones: Characteristics of good quality stones, dressing of building stones, Location of stone queries in Pakistan
3. Aggregate: Properties of aggregates for Roads, Railways and Concrete, Los Angeles Abrasion Test, crushing strength, gradation, soundness test for aggregates
4. Water, Lime, Cement & Timber: Qualities of water used. for concrete mixes. Tests and uses of lime. Methods of manufacture and storage of cement in different conditions. Characteristics, properties and performance of Pakistani timber used. in constructions. Seasoning and preservation of wood. Use of plywood, hard board and chipboard in constructions
5. Paints and Varnishes: Types of paints, Composition, preparation and application of paints, varnishes and distempers in building works
6. Metals: Characteristics and uses of Ferous and non- Ferous metals and their alloys.
7. Glass and Plastics: Varieties, properties and uses of glass, plastics. Properties and uses of asphalt, bitumen, rubber, asbestos and its products, plastic pipes
8. Masonry: Bonds in brick masonry and their formation in building construction, Scaffolding and its importance in construction work. Columns, lintels and slab construction in buildings
9. Construction: Foundation for walls and piers. Load bearing walls in brick and masonry construction, composite walls cavity construction, concrete framed. structures panel walls,

Recommended Texts

1. Smith, R. C. & Andres, C. K. (1987). *Materials of Construction*. Glencoe: McGraw Hill.
2. Ed.ward, A. & Joseph, I. (2013). *Fundamental of Building Construction Materials and Method*. USA: John Wiley & Sons

Suggested Readings

1. Duggal, P. & S. K. (2010). *Building Materials*. India: New Age International.

ISL-116 **Islamic Studies** **2 (2+0)**

Islamic Studies engages in the study of Islam as a textual tradition inscribed. in the fundamental sources of Islam; Qur'an and Hadith, history and particular cultural contexts. The area seeks to provide an introduction to and a specialization in Islam through a large variety of expressions (literary, poetic, social, and political) and through a variety of methods (literary criticism, hermeneutics, history, sociology, and anthropology). It offers opportunities to get fully introductory foundational bases of Islam in fields that include Qur'anic studies, Hadith and Seerah of Prophet Muhammad (PBUH), Islamic philosophy, and Islamic law, culture and theology through the textual study of Qur'an and Sunnah. Islamic Studies is the academic study of Islam and Islamic culture. It majorly comprises of the importance of life and that after death. It is one of the best systems of ed.ucation, which makes an ethical groomed. person with the qualities which he/she should have as a human being. The basic sources of the Islamic Studies are the Holy Qur'an and Sunnah or Hadith of the Holy Prophet Muhammad. The learning of the Qur'an and Sunnah guides the Muslims to live peacefully.

Contents

1. Study of the Qur'an (Introduction to the Qur'an, Selected. verses from *Surah Al-Baqarah, Al-Furqan, Al-Ahzab, Al-Mu'minoon, Al-An'am, Al-Hujurat, Al-Saff*)
2. Study of the Hadith (Introduction to Hadith literature, Selected. Ahadith (Text and Translation)
3. Introduction to Qur'anic Studies
4. Basic Concepts of Qur'an
5. History of Quran
6. Basic Concepts of Hadith
7. History of Hadith
8. Kinds of Hadith
9. Uloom –ul-Hadith
10. Sunnah& Hadith
11. Seeratul-Nabi (PBUH), necessity and importance of Seerat, role of Seerah in the development of personality, Pact of Madinah, KhutbahHajjat al-Wada' and ethical teachings of Prophet (PBUH).
12. Legal Position of Sunnah
13. Islamic Culture & Civilization
14. Characteristics of Islamic Culture & Civilization
15. Historical Development of Islamic Culture & Civilization
16. Comparative Religions and Contemporary Issues
17. Impact of Islamic civilization

Recommended Texts

1. Hassan, A. (1990). *Principles of Islamic jurisprudence*. India: Adam Publishers
2. Zia-ul-Haq, M. (2001). *Introduction to al-Sharia al-Islamia* Pakistan: Aziz Publication

Suggested Readings

1. Hameed.ullah, M. (1957). *Introduction to Islam*. Pakistan: Sh M Ashraf Publisher
2. Hameed.ullah, M. (1980). *Emergence of Islam*. India: Adam Publishers
3. Hameed.ullah, M. (1942). *Muslim conduct of State.* Pakistan: Sh M Ashraf Publisher

CT-121 **Applied. Mechanics** **4 (3+1)**

The primary purpose of the study of the subject is to develop the capacity to pred.ict the effects of force and motion while carrying out the creative design functions of engineering. This capacity requires more than a mere knowled.ge of the physical and mathematical principles of mechanics; also required. is the ability to visualize physical configurations in terms of real materials, actual constraints and the practical limitations which govern the behavior of machines and structures. One of the primary objectives in a mechanics course is to help the student to develop this ability to visualize, which is so vital to problem formulation Indeed. the construction of a meaningful mathematical model is often a more important experience than its solution. Maximum progress is made when the principles and their limitations are learned. together within the context of engineering application. The main aim of this course is to explain basic concepts of statics, force system, equilibrium of rigid bodies, beams, Geometrical properties of plane areas, kinematics, friction, work and Energy. The students will be able to solve problems using concepts of statics & Kinematics to analyze force systems.

Contents

1. Introduction to Statics: Mechanics: Basic concepts, Scalar and vector, Vector addition, subtraction and product, concept and unit of measurements of mass, force, time, space
2. Force System: Force, Introduction, Two-dimensional force system, Rectangular components, Law of triangle, parallelogram law, moment, couple, resultants, solution of problems
3. Equilibrium: Equilibrium in two dimensions, Equilibrium conditions, Free body diagram, solution of problems
4. Beams: Definition, Types of beams, Bending moment and shearing force in simply supported. beams and cantilevers, Solution of problems
5. Geometrical Properties of Plane Area: Introduction, Center of gravity and centroid, Moment of inertia for an area, Parallel-Axis theorem for an area, Radius of gyration of an area, Solution of problems
6. Kinematics of Rectilinear and Curvilinear Motion: Introduction, Displacement, Types of motion, Speed., velocity, acceleration, Equation of motion under uniform acceleration, Normal and tangent acceleration, Solution of problems.
7. Friction: Introduction, Types of friction, Laws of solid friction, Co-efficient of friction, Solution of problems.
8. Work and Energy: Work, Energy, Power, Impulse, Momentum, Simple harmonic motion and free vibration. Introduction to simple trusses and cables, Solution of problems

Recommended Texts

1. Hibbeler, R. C. (2013). *Engineering Mechanics - Statics and Dynamics* (13th Ed.). USA: Prentice Hall
2. Ferdinand P. B. et al. (2018). *Vector Mechanics for Engineers: Static and Dynamics* (12th Ed.). USA: McGraw Hill

Suggested Readings

1. Mariam, J. L. & Kraige, L. G. (2007). *Engineering Mechanics Statics and Dynamics* (6th Ed.). USA: John Wiley & Sons
2. Singer, F. L. (1987). *Engineering Mechanics* (4th Ed.). USA: Harper and Row Publisher

CT-121 **Applied. Mechanics LAB** **4 (3+1)**

The primary purpose of the study of the subject is to develop the capacity to pred.ict the effects of force and motion while carrying out the creative design functions of engineering. This capacity requires more than a mere knowled.ge of the physical and mathematical principles of mechanics; also required. is the ability to visualize physical configurations in terms of real materials, actual constraints and the practical limitations which govern the behavior of machines and structures. One of the primary objectives in a mechanics course is to help the student to develop this ability to visualize, which is so vital to problem formulation indeed. the construction of a meaningful mathematical model is often a more important experience than its solution. Maximum progress is made when the principles and their limitations are learned. together within the context of engineering application. The main aim of this course is to perform the experiments related. to applied. mechanics, estimate the physical parameters using experimental data and justify application of experiments related. to applied. mechanics

Contents

1. To determine the resultant of forces.
2. To study the law of moment and equilibrium conditions.
3. To determine the reaction of a simply supported. beam.
4. To determine the tension in the simple cable.
5. To determine the reaction of a simply supported. truss.
6. To determine the forces in the member of the truss.
7. To draw the shear force and bending moment diagram for one, two and three point load given in experiment no.3.
8. To determine the center of mass of various figures, cut out the wooden plank by experiment & calculations.
9. To find the tension in various parts of a Hanging rope loaded. at various points.
10. To determine the force acting in the tie and jib of a simple jib crane (Wall Crane).
11. To verify the principle of moment.
12. To verify law of friction between solid bodies and to find the coefficient of friction between wood and other materials.

Recommended Texts

1. Hibbeler, R. C. (2013). *Engineering Mechanics - Statics and Dynamics* (13th Ed.). USA: Prentice Hall
2. Ferdinand P. B. et al. (2018). *Vector Mechanics for Engineers: Static and Dynamics* (12th Ed.). USA: McGraw Hill

Suggested Readings

1. Mariam, J. L. & Kraige, L. G. (2007). *Engineering Mechanics Statics and Dynamics* (6th Ed.). USA: John Wiley & Sons
2. Singer, F. L. (1987). *Engineering Mechanics* (4th Ed.). USA: Harper and Row Publisher

MATH-122 **Applied. Mathematics-II** **3 (3+0)**

In physics, economics and engineering, we frequently encounter quantities (for example energy) that depend on many variables (such as position, velocity, and temperature). Usually this dependency is expressed. Through a partial differential equation, and solving these equations is important for understanding these complex relationships. In this course we will study first and second order partial differential equations. The solution methods studied. in this course will include the method of characteristics, separation of variables, Fourier series and Fourier transforms. This course will be useful for majors in economics, mathematical finance, engineering and physics. We will illustrate the theory with examples from these disciplines. This course will provide knowled.ge about Homogeneous linear differential equations of second order, homogeneous equations with constant coefficients, the general solutions, initial and boundary value problems, D- operator, complementary functions and particular integrals. Real, complex and repeated. roots of characteristics equations and Applications of higher order linear differential equations. Ordinary and regular points and corresponding series solutions.

Contents

1. Differential equation; Basic concepts and ideas, geometrical interpretation of first and second order differential equations, separable equations, equations red.ucible to separable form, exact differential equations, integrated. factors, Linear first order differential equations
2. Bernoullill's differential equation. Families of curves, orthogonal trajectories and applications of differential equations of first order to relevant engineering systems.
3. Homogeneous linear differential equations of second order, homogeneous equations with constant coefficients, the general solutions, initial and boundary value problems, D- operator, complementary functions and particular integrals. Real, complex and repeated. roots of characteristics equations.
4. Cauchy equation, non- homogeneous linear equations.
5. Applications of higher order linear differential equations. Ordinary and regular points and corresponding series solutions.
6. Concept of sequence and series.

Recommended Texts

1. Wiley, C.R. (1995) *Advanced. Engineering Mathematics* (6th Ed.). USA: McGraw Hill

Suggested Readings

1. Kreyszig, E. (2007) *Advanced. Engineering Mathematics* (9th Ed.). USA: John Wiley & Sons

ENG-123 **Communication Skills-II** **2 (2+0)**

Communication, at its simplest, is the act of transferring information from one place to another. It may be vocally (using voice), written (using printed. or digital med.ia such as books, magazines, websites or emails), visually (using logos, maps, charts or graphs) or non-verbally (using body language, gestures and the tone and pitch of voice). In practice, it is often a combination of several of these. This course enables students to read and write the research proposals and research articles related. to civil engineering. To inculcate in students the skills of organizing material, writing a report, and presenting their work for business communication. Business communication is the process of sharing information between people within and outside a company. Effective business communication is how employees and management interact to reach organizational goals. Its purpose is to improve organizational practices and red.uce errors. Business communication is used. to promote a product, service, or organization; to relay information within the business; or to deal with legal and similar issues.

Contents

1. Communication Environment: Organizational Structure, International Communication, Nondiscriminatory Communication, Communication Channels.
2. Communication and Technology: Presentation Graphics and Word Processing, Fax, E-mail, Internet and Voice Mail, CD-ROM and Online Databases, Teleconferencing, Audio Visual Aids.
3. Presentation Skills: Defining objective, audience analysis, style and tone, cred.ibility, opening, closing and main ideas, use of Audio Visual Aids.
4. Meetings and Interviews: Participating in Meetings, Chairing a Meeting,
5. Asking and Answering Questions in Meetings, Preparing Resumes, Preparing for Interviews, Asking and Answering Questions in Interviews.
6. Letters and Memos: Formats, Positive and Negative Messages, Persuasive Communication, Requests.
7. Technical Report Writing: Introduction and Importance, General Formats, Short and Long Reports, Proposals, Quoting References.

Recommended Texts

1. Murphy, H. A. et al. *Effective Business Communications* (7th ed.). USA: McGraw Hill
2. Norman, S. (1989). *We're in Business* (1st ed.). UK: Longman

Suggested Readings

1. Thomson A. J. & Martinet A. V. (1961). *A Practical English Grammar* (4th ed.). UK: Oxford University Press

CT-124 **Concrete Technology** **4 (3+1)**

Concrete Technology is one of the fundamental core subjects in Civil Engineering Technology. This course is designed. to provide detailed. knowled.ge of concrete technology specific to the building and construction industry, enabling students to better service the concrete industry specifically and the building and construction industry generally. Concrete is a construction material compose of cement, fine aggregates (sand) and coarse aggregates (crush) mixed. with water which hardens with time. Portland cement is the commonly used. type of cement for production of concrete, which demands detailed. discussion on its hydration process. Concrete technology deals with study of properties of concrete and its practical applications. In a building construction, concrete is used. for the construction of foundations, columns, beams, slabs and other load bearing elements. There are different types of binding material is used. other than cement such as lime for lime concrete and bitumen for asphalt concrete which is used. for road construction.

Contents

1 Concrete properties and its behavior
2 Concrete mix design
3 Mechanical properties of concrete
4 Prestressed. concrete

Recommended Texts

1. Neville, M. (1996) *Properties of Concrete* (4th Ed.). USA: Wiley John & Sons

Suggested Readings

1 Nilson, H. (2009). *Design of Concrete Structures* (14th Ed.). USA: McGraw Hill

CT-124 **Concrete Technology LAB** **4 (3+1)**

Concrete Technology is one of the fundamental core subjects in Civil Engineering Technology. This course is designed. to provide detailed. knowled.ge of concrete technology specific to the building and construction industry, enabling students to better service the concrete industry specifically and the building and construction industry generally. Concrete is a construction material composed. of cement, fine aggregates (sand) and coarse aggregates (crush) mixed. with water which hardens with time. Portland cement is the commonly used. type of cement for production of concrete, which demands detailed. discussion on its hydration process. Concrete technology deals with study of properties of concrete and its practical applications in a building construction, concrete is used. for the construction of foundations, columns, beams, slabs and other load bearing elements. There are different types of binding material is used. other than cement such as lime for lime concrete and bitumen for asphalt concrete which is used. for road construction.

Contents

1. Preparation of a cement paste of Standard Consistency.
2. Determination of Initial and Final setting time of cement.
3. Determination of the consistency of a freshly mixed. concrete through slump Test.
4. Determination of the Workability of a freshly mixed. concrete through compacting factor test.
5. Determination of the compressive strength of concrete cube.
6. Determination of the compressive strength of concrete cylinder.
7. Comparison of cube and cylinder strength.
8. Test on modulus of rupture on beam specimens.
9. Determination of Aggregate Impact Value.
10. Sieve analysis of coarse aggregate.
11. Sieve analysis of fine aggregate.
12. Determination of fineness modulus of coarse and fine aggregate from different sources.

Recommended Texts

1. Neville, M. (1996) *Properties of Concrete* (4th Ed.). USA: Wiley John & Sons

Suggested Readings

1. Nilson, H. (2009). *Design of Concrete Structures* (14th Ed.). USA: McGraw Hill

CT-125 **Surveying** **4 (2+2)**

The main aim of this course is to enable students to understand theory and practice of land surveying. This course covers linear measurements, leveling, compass and transit/theodolite, theory of errors, areas, stadia, coordinate geometry, state plane coordinates and standard map projections. It covers latitudes and departures, legal aspects of land surveying and public land surveys. The main aim of this course is to enable students to understand theory and practice of land surveying. The students will develop an ability to translate survey information for design and construction purposes. This course covers linear measurements, leveling, compass and transit/theodolite, theory of errors, areas, stadia, coordinate geometry, state plane coordinates and standard map projections. It covers latitudes and departures, legal aspects of land surveying and public land surveys. This course will enable students in reading and preparing surveying maps. The course covers land surveying, public land surveys, topographic mapping, horizontal and vertical curves, GPS survey technology hydrographic Surveys and tachometry. In addition, students will develop skills to use modern survey instruments such as such as theodolites, electronic distance meters, electronic total stations, GPS, and optical alignment devices to gather any topographic information.

Contents

1. Survey Instruments: Study and use of conventional surveying instruments and ED.M devices
2. Triangulation and Traversing: Selection of station base line measurement, computations, adjustment, plotting and detailing of triangulation. Introduction and use of Total station. Introduction to GPS
3. Leveling: Introduction to leveling, precise leveling and profile leveling. Errors and correction in leveling, plotting long sections and cross-sections, Trigonometrical leveling and contouring
4. Tachometry: System of techeometry, applications of tachometer in surveying, computation of horizontal and vertical measurements Setting Out Works: Setting out curves (horizontal and vertical), demarcation for buildings, bridges, sewer lines, route lines and tunnels
5. Hydrographic Surveying: Introduction to hydrographic surveying and instruments, sounding methods
6. Astronomy: Introduction to true north, latitude, longitude and time.

Recommended Texts

1. Davis, R. E. et al. (1981). *Surveying Theory and Practice* (6th Ed.). USA: McGraw Hill
2. McCormac, J. C. (2012). *Surveying* (6th Ed.). USA: Wiley

Suggested Readings

1. Wirshing, R. H. et al. (1985). *Schaum's Outline of Introductory Surveying* (1st Ed.). USA: McGraw Hill
2. Clark, D. S. (2004). *Plane and Geodetic Survey*. India: CBS Publishers

CT-125 **Surveying LAB** **4 (2+2)**

The main aim of this lab is to study and practice those experiments that are related. to the basic Surveying techniques being used. for different civil works. Also, this lab enables to handle and use various basic surveying related. instruments. The main aim of this lab is to enable students to understand practice of land surveying. The students will develop an ability to translate survey information for design and construction purposes. This lab covers linear measurements, leveling, compass and transit/theodolite, theory of errors, areas, stadia, coordinate geometry, state plane coordinates and standard map projections. It covers latitudes and departures, legal aspects of land surveying and public land surveys. This lab will enable students in reading and preparing surveying maps. The lab covers land surveying, public land surveys, topographic mapping, horizontal and vertical curves, GPS survey technology hydrographic Surveys and tachometry. In addition, students will develop skills to use modern survey instruments such as such as theodolites, electronic distance meters, electronic total stations, GPS, and optical alignment devices to gather any topographic information.

Contents

1. To acquaint with the minor instruments
2. Study and use of conventional instruments & ED.M surveying instruments
3. Temporary and permanent adjustment of level and theodolite
4. Plotting contour map of an area
5. Traversing of an area by theodolite and total station
6. Leveling and computation by collimation method and rise and fall method
7. Triangulation by theodolite
8. Setting out of Simple Circular Curve by chain and tape using method of offsets from long chord
9. Setting out of Simple Circular Curve by chain and tape using method of offsets from the Tangents
10. Layout of a Building using Tape

Recommended Texts

1. Davis, R. E. et al. (1981). *Surveying theory and practice* (6^{th} Ed.). USA: McGraw Hill
2. McCormac, J. C. (2012). *Surveying* (6^{th} Ed.). USA: Wiley

Suggested Readings

1. Wirshing, R. H. et al. (1985). *Schaum's outline of introductory surveying* (1^{st} Ed.). USA: McGraw Hill
2. Clark, D. S. (2004). *Plane and geodetic Survey.* India: CBS Publishers

MATH-211 **Applied. Mathematics-III** **3 (3+0)**

This course enables students to understand the concept of matrices and determinants. To understand the concept and use of partial differential equations and their applications. Applied. mathematics is the application of mathematical methods by different fields .i.e., physics, engineering, med.icine, biology, business, computer science, and industry. Thus, applied. mathematics is a combination of mathematical science and specialized. knowled.ge. The term "applied. mathematics" also describes the professional specialty in which mathematicians work on practical problems by formulating and studying mathematical models. The main aim of the subject is developed. students' problem-solving skills using the techniques of calculus through numeric, analytic, graphical, and symbolic approaches. This course introduces students to the theory of boundary value and initial value problems for partial differential equations with emphasis on linear equations. This course also introduces basic techniques pertaining to matrices, formulation/solution of differential equations and Fourier series. In mathematics, a differential equation is an equation that relates one or more functions and their derivatives.

Contents

1. Linear Algebra: Basic concepts of matrices and determinants, addition, subtraction, multiplication, linear system of equations and their solutions, Gauss elimination technique, Row red.uced. Echelon form, Rank of the matrices, Inverse of matrices, Gauss Jordan method, Determinants, Crammers rule, Eigen values and Eigen vectors.
2. Vector differential calculus, Gradient, Divergence, and curl, and concepts of vector integral calculus.
3. Partial Differential equations: Fourier series, Basic concepts of Partial Differential Equations, Wave equation, Heat Equation, Laplace’s equation, Poisson Equation and their solutions by using Fourier Series, and Laplace transforms.

Recommended Texts

1. Wiley, C.R. (1995) *Advanced. Engineering Mathematics* (6th Ed.). USA: McGraw Hill

Suggested Readings

1. Kreyszig, E. (2007) *Advanced. Engineering Mathematics* (9th Ed.). USA: Wiley

CT-212 **Hydrology** **4 (3+1)**

An understanding of hydrology opens the door to a variety of interesting engineering problems that are especially relevant in today's world. The main aim of studying this subject is to understand the response to a watershed. to various meteorological events such as large storms, hurricanes and snow melt. A civil engineer with skill in hydrology can analyze these events to pred.ict flood levels, design reservoirs and dams and size culverts and drains, and generally develop an engineering plan to manage water that results from storm events. There are numerous disciplines within the field of hydrology including drainage engineering, flood analysis, river mechanics, groundwater engineering and a number of other specialties. The field of hydrology also compliments disciplines such as geology, soil mechanics, water resources, land-use planning, agricultural engineering and several other fields. This course aims at familiarizing the students to learn broad areas of hydrological engineering and principles of water Management.

Contents

1. Definition and significance of hydrology. The hydrologic cycle and hydrologic equation
2. Atmosphere and its composition. Measurement of air temperature, relative humidity, radiation, sunshine and atmospheric pressure
3. Types and measurement of precipitation. Rain gauges, Variations in precipitation. Computation of average precipitation
4. Evaporation and Transpiration, Factors affecting evaporation, Determination of evaporation.
5. Evapotranspiration and potential evapotranspiration. Variations in evapotranspiration and transpiration
6. Stream Flow measurement, Water stage and its measurement. Site selection for water stage. Selection of control and metering section. Methods of measurement of stream flow.
7. Introduction to Runoff, Factors affecting storm runoff. Methods of estimating storm runoff.
8. Introduction to unit hydrograph. Rational method for calculation of runoff. Introduction to low flow and flood flow frequency.
9. Frequency- duration analysis, Introduction to intensity-duration-frequency function for precipitation
10. Groundwater Flow: Zones of underground water. Water table Sources of groundwater
11. Types of aquifers. Various types of wells. Equilibrium equations for flow of water into wells.
12. Tube well and its components, Borehole pumping test. And Development of tube wells.

Recommended Texts

1. Linsley, R. K. et al. (1982). *Hydrology for Engineers* (1st Ed.). USA: McGraw Hill
2. Singh, V. (2016). *Handbook of Applied. Hydrology* (2nd Ed.). USA: McGraw Hill

Suggested Readings

1. Linsley, R. K. et al. (1991). *Water Resource Engineering* (4th Ed.). USA: McGraw Hill.

CT-212 **Hydrology LAB** **4 (3+1)**

An understanding of hydrology opens the door to a variety of interesting engineering problems that are especially relevant in today's world. The main aim of studying this subject is to understand the response to a watershed. to various meteorological events such as large storms, hurricanes and snow melt. A civil engineer with skill in hydrology can analyze these events to pred.ict flood levels, design reservoirs and dams, size culverts and drains, and generally develop an engineering plan to manage water that results from storm events. There are numerous disciplines within the field of hydrology including drainage engineering, flood analysis, river mechanics, groundwater engineering and a number of other specialties. The field of hydrology also compliments disciplines such as geology, soil mechanics, water resources, land-use planning, agricultural engineering and several other fields. This course aims at familiarizing the students to learn broad areas of hydrological engineering and principles of water Management in hydrology lab.

Contents

1. Determination of velocity and discharge using current meter
2. Determination of velocity and discharge using floats
3. Study of the barometer
4. Study of the rainfall gauge
5. Measurement of wind velocity
6. Measurement of humidity
7. Measurement of atmospheric temperature

Recommended Texts

1. Linsley, R. K. et al. (1982). *Hydrology for Engineers* (1st Ed.). USA: McGraw Hill
2. Singh, V. (2016). *Handbook of Applied. Hydrology* (2nd Ed.). USA: McGraw Hill

Suggested Readings

1. Linsley, R. K. et al. (1991). *Water Resource Engineering* (4th Ed.). USA: McGraw Hill.

CT-213 **Fluid Mechanics** **4 (3+1)**

The flow of fluids is important in many applications ranging from blood flow in the human body to the air flow over the wing of a jet aircraft and water flowing in pipes, canals and rivers. As a result, fluid mechanics is not only the providence of the civil engineer but is truly a multi-disciplinary field attracting researchers in mechanical engineering, chemical engineering, materials science, petroleum engineering, environmental science, meteorology, geology, and astronomy. This course will help students in understanding the nature of fluid statics, in particular dealing with problems related. to hydrostatic forces and to analyze the problems related. to elementary fluid dynamics especially for incompressible flows using Bernoulli equation in particular. Students will develop skills to use flow Measurement devices like ventrimeter and Pitot tube. Students will characterize and determine the forces resulting from the interaction of flow with immersed. bodies. In addition, this course will enable students to solve problems relating to pipe flow and open channel flow.

Contents

1. Introduction: Applications of fluid mechanics.
2. Units and dimensions
3. Physical Properties of Fluids: Density, specific weight and specific gravity. Viscosity. Newton’s law of viscosity Fluid Statics:
4. Pressure. Absolute and gauge pressure. Measurement of pressure, Piezometer, manometer, differential manometer and bourdon gauge.
5. Buoyancy, Metacenter and metacentric height.
6. Fluid Kinematics: Basic concepts from steady and unsteady flow. Laminar and turbulent flow. Uniform and non-uniform flow. Velocity and discharge. Continuity equation
7. Hydrodynamics: Different forms of energy in a flowing liquid, Energy head, Bernoulli’s equation and its applications Flow Measurement: Measurement of velocity. Pitot tube. Measurement of discharge through orifices, notches, weirs and venturimeter
8. Steady Flow Through Pipes: Darcy Weisbach equation for flow in pipes. Hazen William’s formula, Losses in pipelines, hydraulic grade lines and energy lines
9. Uniform Flow in Open Channels: Chazy’s and Manning equation, Most efficient economical rectangular and trapezoidal sections

Recommended Texts

1. Webber, N. B. (1990). *Fluid Mechanics for Civil Engineers* (1st Ed.). UK: Chapman & Hall
2. Dougherty, R. L. et al. (1985). *Fluid Mechanics with Engineering Applications* (1st Ed.). USA: McGraw Hill

Suggested Readings

1. Pritchard, P. J. (2011). *Fox and McDonald’s Introduction to Fluid Mechanics* (8th Ed.). USA: Wiley
2. Massey, B. S. (1979). *Mechanics of Fluids* (4th Ed.). USA: Van Nostrand Reinhold Inc

CT-213 **Fluid Mechanics LAB** **4 (3+1)**

The flow of fluids is important in many applications ranging from blood flow in the human body to the air flow over the wing of a jet aircraft and water flowing in pipes, canals and rivers. As a result, fluid mechanics is not only the providence of the civil engineer but is truly a multi-disciplinary field attracting researchers in mechanical engineering, chemical engineering, materials science, petroleum engineering, environmental science, meteorology, geology, and astronomy. This lab will help students in understanding the nature of fluid statics, in particular dealing with problems related. to hydrostatic forces and to analyze the problems related. to elementary fluid dynamics especially for incompressible flows using Bernoulli equation in particular. Students will develop skills to use flow Measurement devices like ventrimeter and Pitot tube. Students will characterize and determine the forces resulting from the interaction of flow with immersed. bodies. In addition, this course will enable students to solve problems relating to pipe flow and open channel flow.

Contents

1. Determination of viscosity of a given liquid using viscometer
2. Determination of velocity through Pitot tube
3. Determination of coefficient of discharge using venturi meter
4. Determination of coefficient of discharge using orifice meter
5. Determination of coefficient of discharge of the orifices
6. Determination of coefficient of discharge using rectangular notch
7. Determination of discharge using V-notch
8. Determine the head loss in pipes connected. in parallel
9. Determine the head loss in pipes connected. individually
10. Determine the head loss in pipes connected. in series
11. To investigate the validity of the Bernoulli's equation for steady flow of water.

Recommended Texts

1. Webber, N. B. (1990). *Fluid mechanics for civil engineers* (1st Ed.). UK: Chapman & Hall
2. Dougherty, R. L. et al. (1985). *Fluid Mechanics with Engineering Applications* (1st Ed.). USA: McGraw Hill

Suggested Readings

1. Pritchard, P. J. (2011). *Fox and Mcdonald's introduction to fluid mechanics* (8th Ed.). USA: Wiley
2. Massey, B. S. (1979). *Mechanics of fluids* (4th Ed.). USA: Van Nostrand Reinhold Inc

CT-214 Mechanics of Materials 4 (3+1)

The primary purpose of this subject is to explain the basic concepts of the magnitudes and distribution of internal forces in the body with the help of free body diagram under external loads. Analysis of stresses and strains due to combined. effect of all types of forces, using analytical and Mohr's Circle methods are also discussed. Mechanics of Materials gives the student basic tools for stress, strain and deformation analysis. Methods for determining the stresses, strains and deformations produced. by applied. loads are presented. Engineering design concepts are integrated. Throughout the course. Analysis and design components and structural members subjected. to tension, compression, torsion, bending and combined. loads using fundamental concepts of stress, strain, elastic and inelastic behavior will also be discussed. The students will be able to understand the basic concepts and principles of strength of materials and will develop the ability to analyze a given problem in a simple manner and will be able to calculate stresses and deformations of objects under external forces

Contents

1. Simple Stress & Strain: Kind of stresses and strain, Hook's law, Modulus of elasticity, Lateral & Volumetric strain, Poison's ratio Load extension diagrams for different materials, Temperature stresses and compound bars Principle Stress & Strain: Construction of Mohr's circle for stress & strain.
2. Bending Theory: Theory of simple bending, position of neutral axis, moment of resistance and section modulus, Bending and shearing stress distribution in beams; Relationship between load, shear force and bending moment.
3. Slope and Deflection of Beams: Relation between slope deflection and radius of curvature. Slope and deflection of a beam using Integration method
4. Strain Energy: Strain energy due to direct loads, shear force, bending moment and torque. Stresses due to impact load.
5. Transfer of Torque in Structural Member: Theory of torsion in circular shafts. Derivation of torsion equation and its application to solid and hollow circular cross-section. Sources of torsion in structures
6. Columns and Struts: Behavior of short and long columns. Euler's theory of buckling of long columns and other empirical formulae

Recommended Texts

1. Hibbeler, R. C. (2016). *Mechanics of materials* (10th Ed.). USA: Pearson

Suggested Readings

1. Beer, F. et al. (2010). *Statics and Mechanics of materials* (1st Ed.). USA: McGraw Hill

CT-214 **Mechanics of Materials LAB** **4 (3+1)**

Mechanics of Materials course, deals with the behavior of solid objects subject to stresses and strains. The complete theory begins with the consideration of the behavior of one and two dimensional members of structures, whose states of stress can be approximated. as two dimensional, and is then generalized. to three dimensions to develop a more complete theory of the elastic and plastic behavior of materials. This course also includes various methods of calculating the stresses and strains in structural members, such as beams, columns, and shafts. The methods employed. to pred.ict the response of a structure under loading and its susceptibility to various failure modes takes into account the properties of the materials such as its yield strength, ultimate strength, Young's modulus, and Poisson's ratio; in addition the mechanical element's macroscopic properties (geometric properties), such as its length, width, thickness, boundary constraints and abrupt changes in geometry such as holes are considered.

Contents

1. To perform tensile test on a mild steel specimen and to determine yield strength, ultimate strength, rupture strength and percentage elongation.
2. Hardness test on a given metal specimen using Avery‟s Rockwell testing machine.
3. To perform the Izod Impact Test for the given metals.
4. To perform the Charpy‟s Impact Test for the given metals.
5. To determine shear strength of a half-inch dia steel bar
6. To determine the modulus of elasticity of the material of given rectangular beam
7. To determine modulus of rigidity of the material of given specimen with circular cross-section
8. To perform Bending test on wooden beam

Recommended Texts

1. Hibbeler, R. C. (2016). *Mechanics of Materials* (10th Ed.). UK: Pearson

Suggested Readings

1. Beer, F. et al. (2010). *Statics and Mechanics of Materials* (1st Ed.). USA: McGraw Hill

CT-215 **Engineering Geology** **2 (2+0)**

Geology is the study of earth, its constituent and its structure. It mainly deals with rock, its formation, types, stresses, deformation. It also explains on “Rock as building material” and its properties. Engineering geology is the application of the geological sciences to engineering projects. It helps to understand properties of different types of rocks, soils to be used. in construction and their applications in foundation works. It is aimed. at studying the geology of an area for the purpose of assuring that the geological factors regarding the location, design, construction, operation and maintenance of engineering works, are perfect for the project implementation. It is also done during post-construction and forensic phases of the projects. Engineering geologists provide geological and geotechnical recommendations, analysis, and design associated. with human development and various types of structures. Engineering geology is a promising subject for operational applications of geological knowled.ge. The future lies in this subject as it will increase opportunities for students specializing in this field.

Contents

1. Introduction: Introduction to various branches of geology, Origin and internal constitution of the earth.
2. Rocks and Minerals, Structural Features :Main groups, Igneous, sed.imentary and metamorphic rocks, Important minerals and ores, Rock cycle, Glaciers and glaciations, Dip, strike, folds, faults, joints, unconformities conformable and un conformable series of strata,
3. Weathering and Erosion, Volcanoes: Agents of weathering and erosion, Weathering classification, Cycle of erosion, normal, glacial and marine erosion, Land forms, Mass wasting, Formation of meanders and ox-bow lakes, Formation of volcanoes, Causes of volcanoes, Nature and types of volcanic eruptions, Products of eruptions, Types of volcanoes, Geysers
4. Landslides: Definition, causes of landslides, Classification of landslides, Preventive measures against landslides
5. Earthquakes: Definition and related. technical terms, Causes of earthquake, Classification of earthquakes, Earthquake or seismic waves, Mechanism of earthquake, Measuring of earthquake intensity (modified. mercali intensity scale), Effects of earthquake and protective measures against earthquake
6. Tunneling: Engineering geology of tunnels, Geological survey prior to tunneling, Lining of tunnels and their section, Selection of tunnel site and its requirements.
7. Geological Survey Maps: Physical method of subsurface mapping, Exploratory geological surveys at engineering sites
8. Engineering Applications : Importance of geology for civil engineering projects, Important building stones and other construction materials, Role of geology in selection of sites for dams, reservoirs and pertinent geological investigations, Geology of foundations, cutting tunnels, highways, airfields and bridges

Recommended Texts

1 Bell, F. G. (2007). *Engineering Geology* (2nd Ed.). UK: Butterworth-Heinemann

Suggested Readings

1. Waltham, T. (2009). *Foundations of Engineering Geology* (3rd Ed.). USA: McGraw Hills

CT-221 **Soil Mechanics** **4 (3+1)**

The main aim of this course is to acquaint students with the branch of science dealing with structure, engineering properties and reactions (behavior) of soils under loading, weathering and varying environmental conditions i.e. Soil Mechanics. It studies soils theoretically and practically for building of structures using it and over it using knowled.ge of physics, mechanics, and hydraulics applied. to study the behavior. The science deals with the physical properties of soils and the relevance of these properties as they affect soil strength, stability, and drainage. This course is aimed. to establish a sound understanding of mutual interaction of soils and structures with the help of Soil Mechanics as it is the basis for all geotechnical applications, be it integrity of a structure or stability of a road or dam. Starting from origin of soil, the course covers the fundamental multi-phase nature of soils, provides an understanding of soil description and classification, stress related. concepts, seepage, settlement and compaction problems.

Contents

1. Principle properties of soil (natural moisture content, density, specific gravity, void ratio, porosity, degree of saturation).
2. Volumetric and volume weight relationships.
3. Index properties of soil (grain size distribution, consistency limits).
4. Purpose of soil classification
5. Engineering soil classification systems (ASTM or USCS, AASHTO)
6. Permeability & Seepage: Definition, scope
7. Darcy's law, laboratory and field methods of determining permeability
8. Seepage, seepage control, filters
9. Stresses in soil: geostatic stresses, total and effective stresses,
10. Stress from surface loads. Lateral stress, stress influence charts/diagrams and their uses
11. Compressibility & shear strength: definitions,
12. Consolidation, consolidation test and data red.uction,
13. Naturally consolidated. clayey and partially consolidated. clayey soils,
14. Settlement and rate of settlement.
15. Shear strength; Coulomb's law, shear strength parameters (c &φ), cohesive & non-cohesive soils.
16. Laboratory and field evaluation of (c &φ). Utility of shear strength parameters
17. Compaction & ground improvement; moisture density relationship
18. Laboratory and field compaction methods.
19. Compaction control during construction, factors affecting compaction
20. Ground improvement techniques – dynamic compaction, pre-loading, vibrator
21. Site selection and exploration: scope and objective, exploration methods
22. Field tests; SPT,CPT, plate load test, pressure meter, dilatometer test

Recommended Texts

1. Qureshi, M. S. & Akber, A. (1997). *Fundamentals of soil mechanics* (2nd ed.). Pakistan: A-One Publishers.
2. Coduto, D. P. et al. (2010). *Geotechnical engineering: Principles & practices* (2nd ed.). UK: Pearson

Suggested Readings

1. Taylor, D. W. (1963). *Fundamentals of soil mechanics* (1st ed.). USA: John Wiley & Sons.
2. Terzaghi, K. et al. (1996). *Soil mechanics in engineering practice* (3rd ed.). USA: Wiley

CT-221 **Soil Mechanics LAB** **4 (3+1)**

The main aim of this lab is to acquaint students with the branch of science dealing with structure, engineering properties and reactions (behavior) of soils under loading, weathering and varying environmental conditions i.e. Soil Mechanics. It studies soils theoretically and practically for building of structures using it and over it using knowledge of physics, mechanics, and hydraulics applied. to study the behavior. The science deals with the physical properties of soils and the relevance of these properties as they affect soil strength, stability, and drainage. This course is aimed. to establish a sound understanding of mutual interaction of soils and structures with the help of Soil Mechanics as it is the basis for all geotechnical applications, be it integrity of a structure or stability of a road or dam. Starting from origin of soil, the course covers the fundamental multi-phase nature of soils, provides an understanding of soil description and classification, stress related. concepts, seepage, settlement and compaction problems.

Contents

1. To perform Sieve analysis test.
2. To perform Hydrometer analysis test.
3. To perform Specific gravity test.
4. To perform Moisture content determination test.
5. To perform Atterberg limits test.
6. To perform Field identification tests.
7. To perform Permeability by constant and variable head test.
8. To perform AASHO and modified. AASHO test.
9. To perform Density in situ by sand replacement and rubber balloon method.
10. To perform Relative density test

Recommended Texts

1. Qureshi, M. S. & Akber, A. (1997). *Fundamentals of soil mechanics* (2nd ed.). Pakistan: A-One Publishers.
2. Coduto, D. P. et al. (2010). *Geotechnical engineering: Principles & practices* (2nd ed.). UK: Pearson

Suggested Readings

1. Taylor, D. W. (1963). *Fundamentals of Soil Mechanics* (1st Ed.). USA: John Wiley & Sons.
2. Terzaghi, K. et al. (1996). *Soil Mechanics in Engineering Practice* (3rd Ed.). USA: Wiley

CT-222 Highway and Transportation Engineering 4 (3+1)

The main aim of this course is to provide background knowledge of transportation engineering with detailed. and thorough understanding of framework of various transportation systems. Transportation engineering primarily involves planning, design, construction, maintenance, and operation of transportation facilities. Transportation Systems contains Physical "fixed." facilities: highways; railroads; airport; sea & river ports; pipelines and canals. Flow entities: fleets of vehicles; vessels and aircrafts. Control systems refer to the technological ways in which individual vehicles are guided. on fixed. facilities. They include means that permit the efficient safe and smooth operation of streams of vehicles and reduce conflicts between vehicles [Signing; Marking and signaling] Carry out geometric design based. on best practices and guidelines. Apply the basics of traffic engineering for effective traffic management. Explore the Fundamentals of Traffic Flow, Traffic Studies, Concepts of Capacity and Level of Service, Travel Demand Forecasting for Highways. Learn the basic concepts of pavement analysis and design. Design the rigid and flexible pavements.

Contents

1. Introduction to Transportation Systems and Planning: Modes of transportation, need and scope of comprehensive plan, Phases of planning, Principles of planning, Communication (road network, rail-road network & airport), port and harbor facilities, Introduction to design aspects, Overview of Mass Transit Systems
2. Highway Geometric Design: Horizontal Alignment, Vertical Alignment, Sight Distance, Other Fundamentals of Geometric Design
3. Railway Engineering: Elements of track, Types of gauges, Types of rail sections, Rail joints, Creep and wear of rail, Fish Plate bearing plates and check rails, Types of sleepers, their merits and demerits, Sleeper density spacing and stiffness of track, Types of ballast, Requirements for good ballast, Renewal of ballast, Formation of single and double track
4. Airport Engineering: Type &elements of Airport planning, Factors affecting Airport Site Selection, Airport Classification, Airport Drainage Systems, Various Runway Configurations
5. Pavement Design: Types of pavements, Wheel loads, Equivalent single axle load, Repetition and impact factors, Load distribution characteristics, Design of flexible and rigid pavements, Highway drainage, Pavement failures,
6. Traffic Engineering: Operating and design speeds, Traffic flow parameters, their relationships and data collection methodologies, Traffic Survey, O & D Survey, Traffic Safety,

Recommended Texts

1. Yu, J. C. (1982). *Transportation Engineering: Introduction to Planning, Design and Operations* (1st Ed.): Elsevier Science Ltd
2. Mannering, F. L. et al. (2008). *Principles of highway engineering and traffic analysis* (4th Ed.). USA: John Wiley & Sons

Suggested Readings

1. Horonjeff, R. (1993). *Planning and Design of Airports* (4th Ed.). USA: McGraw-Hill
2. Tsinker, G. P. (2004). *Port Engineering Planning Construction Maintenance and Security* (1st Ed.). USA: Wiley

CT-222 Highway and Transportation Engineering LAB 4 (3+1)

The main aim of this Lab work is to provide background knowledge of transportation engineering with detailed. and thorough understanding of framework of various transportation systems. Transportation engineering primarily involves planning, design, construction, maintenance, and operation of transportation facilities. Transportation Systems contains Physical “fixed” facilities: highways; railroads; airport; sea & river ports; pipelines and canals. Flow entities: fleets of vehicles; vessels and aircrafts. Control systems refer to the technological ways in which individual vehicles are guided. on fixed. facilities. They include means that permit the efficient safe and smooth operation of streams of vehicles and red.uce conflicts between vehicles [Signing; Marking and signaling]. Carry out geometric design based. on best practices and guidelines. Apply the basics of traffic engineering for effective traffic management. Explore the Fundamentals of Traffic Flow, Traffic Studies, Concepts of Capacity and Level of Service, Travel Demand Forecasting for Highways. Learn the basic concepts of pavement analysis and design. Design the rigid and flexible pavements

Contents

1. Drawing of roads and railway in cuttings and fillings
2. Exercises in drawing layouts of intersections and islands
3. Exercises to calculate the quantities of materials required. for various types of pavements and various sections of highways
4. Drawing sheet showing plans and profile of a road
5. Drawing sheet showing general layout of airport buildings
6. Detail drawings of different rail fastenings
7. Exercises for provision of transition curves and re-alignments of curves.
8. Properties of Aggregates: Crushing, Abrasion, Impact, Soundness, Shape, Specific gravity and absorption tests
9. Properties of Bitumen: Ductility, flash and fire point, penetration grade, Softening Point test

Recommended Texts

1. Yu, J. C. (1982). *Transportation Engineering: Introduction to Planning, Design and Operations* (1st Ed.): Elsevier Science Ltd
2. Mannering, F. L. et al. (2008). *Principles of highway engineering and traffic analysis* (4th Ed.). USA: John Wiley & Sons

Suggested Readings

1. Horonjeff, R. (1993). *Planning and Design of Airports* (4th Ed.). USA: McGraw-Hill
2. Tsinker, G. P. (2004). *Port Engineering Planning Construction Maintenance and Security* (1st Ed.). USA: Wiley

CT-223 Quantity Surveying and Contract Document 3 (3+0)

Quantity surveying is the process of analyzing a construction project. Quantity surveying profession has changed. over time to adapt to the changing and increasing requirements of project owners. The main aim of this course is the study of taking off the various quantities and the expected. Expenditure to be incurred. on a particular civil engineering work or project using different techniques. From inception to execution, the fundamental approach of quantity surveying is to find the feasibility of any given work and also quantifying the amount of construction resources such as materials, labor, and equipment. This course introduces the basics of quantity surveying methods and different contracting and tendering techniques involved. in any civil engineering project. The main objective of this course is to enhance the ability of the student to learn various principles of computation related. to quantity surveying like Rough and detailed. cost estimates, bill of quantities aims at familiarizing the students with estimation techniques, rate analysis, contract documents and different tendering procedures for various Civil Engineering Projects.

Contents

1. Working out earthwork quantities for various civil engineering constructions. Calculating quantities for road embankments in plain and hilly areas and for irrigation channels
2. Scheduled. and non-scheduled. rates. Analysis of rates, abstract of costs
3. Significance of rate analysis and its application to market rates of material and labor. Rate analysis for various items of civil engineering works
4. Systematic and logical approach to the estimating and costing of civil engineering works, rough cost & detailed. estimates, bill of quantities and part bills for construction, costs and profit margins to be considered. in the cost estimates.
5. Estimates for roads, buildings, reservoirs, water supply, drainage projects, steel works and bridge construction. Estimates using computer spreadsheets.
6. Introduction to work contracts and tendering. Types of contracts. Requirements of a specific contract, drawings necessary for contract and those required. during the execution of work.
7. Tender documents, construction specifications, bill of quantities and other setting out data required. for a contract.
8. Time scheduling of different construction activities for the execution of the projects. General conditions of contract and special conditions of contract.
9. Safety and control aspects required. in the execution of the contract
10. Introduction of different planning commission Performa’s and measurement books. Labor output, incentives and laws.

Recommended Texts

1 Dutta, B.N. (2002). *Estimating and Costing in Civil Engineering: Theory and Practice Including Specifications and Valuation* (27th Ed.). India: UBS Publishers

Suggested Readings

1. Kohli, D. D. & Kohli, R. C. (2013). *A Textbook of Estimating and Costin.* (13th Ed.). India: S Chand Publishing

CT-224 Material Testing Repair and Maintenance 2 (2+0)

The objective of this subject is to discuss different types of failure of building structures and their measures and should have well awareness of the rules and regulations of maintenance. The objective of testing is to check the material strength against different loading conditions, to tell the suitability of different structural materials for different construction projects, to determine the properties of the raw material, to check quality at intermediate stages in production processes, to check finished. products, and to aid research. The need. to improve the ability of an existing building to withstand seismic forces arises usually from the evidence of damage and poor behavior during a recent earthquake. The objective of repair and maintenance is to preserve different facilities of buildings and to keep them in good working condition. The course also seeks to recognize the mechanisms of degradation of concrete structures, provide the students with the knowledge of available techniques and their application for strengthening or upgrading existing structural systems. It also provides how to conduct field monitoring and non-destructive evaluation of concrete structures.

Contents

1. Material Testing: Destructive and Non-destructive test, Mechanical properties, Method of testing of Fatigue test, impact and hardness test, tensile test and mild steel specimen.
2. Repair and Maintenance of Civil Works: Introduction to different types of failures in building structures and their causes, Assessment of damage by different methods including non- destructive methods, Introduction to Rules and Regulations of Maintenance, Repair and Maintenance Measures.

Recommended Texts

1. Sharma, S.K. (2018). *Textbook of Building Construction* (6th ed.). India: S Chand & Co

Suggested Readings

1. Modi, P. I. & Patel, C. N. (2016). *Repair and Rehabilitation of Concrete Structures* (1st ed.). India: PHI Learning
2. Varghese, P. C. (2014). *Maintenance, Repair & Rehabilitation & Minor Works of Buildings* (1st ed.). India: Prentice Hall

MS-225 **Total Quality Management** **2 (2+0)**

This course will teach students how to use a combination of strategy, data, and effective communication to integrate quality into all aspects of your organization. This course will help students understand total quality concept and techniques for managing, controlling, and improving quality. This course exposes students to contemporary knowledge and techniques of TQM. This would in turn enable the participant to articulate and implement quality improvement processes in the workplace, in line with the philosophy of Total Quality Management. Students will be able to determine the impact of quality on profitability, Adopt TQM as a fundamental business strategy, Communicate the importance of customer focused. TQM, use seven quality control (QC) tools for data collection and analysis, Implement a business strategy driven by Total Quality Management (TQM), Accomplish the cultural transformation necessary for successful implementation of total quality practices. This course also Familiarize students with quality management & environmental management systems.

Contents

1. Quality: Introduction, quality concepts, significance of quality, Total quality, concept of TQM, Principles of TQM
2. Commitment and Leadership: Introduction, Commitment & policy, creating or changing the management culture, Effective leadership.
3. Charting/Planning: Introduction, Operation, Process/Flow charting (including some advance diagrams or charts etc.), Chart symbols, purchasing parameters, Planning for JIT
4. Design for quality: Introduction, Innovation, Quality function development and the house of quality
5. Quality related costs: Prevention, Appraisal & failure costs, Models for quality costing
6. Quality measurements: Significance, inspection planning, Gauging, Measurements
7. Implementing TQM: TQM & Management of change, planning, The implementation of TQM, Sustained improvement
8. Quality Management System (ISO 9000 series): Significance, Documentation, Implementation & certification, Audits, Expected problems
9. Environmental Management System (ISO 14000 series): Significance
10. Documentation, Implementation & certification, Audits, Expected problems

Recommended Texts

1. Feigenbaum, A.V. (1991). *Total Quality Control* (3rd Ed.). USA: McGraw Hill

Suggested Readings

1. Oakland, J. S. (1993). *Total Quality Management* (2nd Ed.). USA: Wiley

CT-226 **Theory of Structure** **4 (3+1)**

This course is the continuation of Engineering Mechanics to further advanced. level. It is pertinent to mention here that structure refers to a system of connected. parts used. to support a load. Important examples related. to civil engineering include buildings, bridges, and towers; and in other branches of engineering, ship and aircraft frames, tanks, pressure vessels, mechanical systems, and electrical supporting structures are important. Once a preliminary design of a structure is proposed. the structure must then be analyzed. to ensure that it has its required. stiffness and strength. To analyze a structure properly, certain idealizations must be made as to how the members are supported. and connected. together. The loadings are determined. from codes and local specifications, and the forces in the members and their displacements are found using the theory of structural analysis, which is the subject matter of this course. The objectives of this course are to develop the understanding of the behavior of determinate structures, provide the concept of statically indeterminate structures illustrating their application to structures like beams, trusses as well as rigid frames and understand the behavior of arches and suspension cables.

Contents

1. Determinacy of Structures
2. Analysis of Determinate Structures
3. Moment Distribution Method
4. Influence Lines diagrams
5. Maximum shear force and bending moment for moving loads
6. Rotation and Deflection
7. Beams and frames under complex Loading

Recommended Texts

1. Wang, C. K. (1969). *Statically Indeterminate Structures* (1st Ed.). USA: McGraw Hill
2. Timoshenko, S. P. & Young, D. H. (1965) *Theory of Structures* (2nd Ed.). USA: McGraw Hill

Suggested Readings

1. Hibbeler, R. C. (2018). *Structural Analysis* (10th Ed.). UK: Pearson
2. Kurrer, K. E. (2018). *The History of the Theory of Structures: Searching for Equilibrium* (2nd Ed.). USA: Wiley

CT-226 **Theory of Structure LAB** **4 (3+1)**

This lab course is the continuation of Engineering Mechanics lab to further advanced. level. It is pertinent to mention here that structure refers to a system of connected. parts used. to support a load. Important examples related. to civil engineering include buildings, bridges, and towers and in other branches of engineering, ship and aircraft frames, tanks, pressure vessels, mechanical systems, and electrical supporting structures are important. Once a preliminary design of a structure is proposed. the structure must then be analyzed. to ensure that it has its required. stiffness and strength. To analyze a structure properly, certain idealizations must be made as to how the members are supported. and connected. Together The loadings are determined. from codes and local specifications, and the forces in the members and their displacements are found using the theory of structural analysis, which is the subject matter of this lab. The objectives of this lab are to develop the understanding of the behavior of determinate structures, provide the concept of statically indeterminate structures illustrating their application to structures like beams, trusses as well as rigid frames and understand the behavior of arches and suspension cables.

Contents

1. To study determinacy of structures including beams, trusses and frames.
2. To analyze determinate structures including beams, trusses and frames.
3. To study and analyze common types of arches, cables and suspension bridges.
4. To practice problems by moment distribution method.
5. To practice formation of influence lines diagrams.
6. To develop concepts about maximum shear force and bending moment for moving loads.
7. To study rotation and deflection by unit load method.
8. To practice problems by moment area method.
9. To practice problems by conjugate beam method.
10. To analyze statically determinate beams and frames under complex loading.

Recommended Texts

1. Wang, C. K. (1969). *Statically Indeterminate Structures* (1st Ed.). USA: McGraw Hill
2. Timoshenko, S. P. & Young, D. H. (1965) *Theory of Structures* (2nd Ed.). USA: McGraw Hill

Suggested Readings

1. Hibbeler, R. C. (2018). *Structural Analysis* (10th Ed.). UK: Pearson
2. Kurrer, K. E. (2018). *The History of the Theory of Structures: Searching for Equilibrium* (2nd Ed.). USA: Wiley

CT-311 Irrigation and Hydraulic Engineering 4 (3+1)

This course is divided. into two parts, hydraulics engineering and irrigation engineering. In hydraulics engineering advanced. concepts of fluid mechanics in relation to viscous flows are introduced. It covers laminar flows, transition to turbulence and turbulent flows and will be taught with civil engineering applications in mind. The students should understand the topics of non-uniform flow and unsteady flow in open channel, turbo machinery, and sediment transport from the fundamental point of view. The students will also be able to analyze similitude & dimensional analysis and uniform flow in open channels. Irrigation engineering takes a special place in the field of water resources engineering as it has the potential to bring economic welfare and food security, but also has the potential to be harmful and destructive. Sound knowledge of the underlying principles and fundamentals is required. to ensure irrigation engineering is practiced. in a sustainable manner. Irrigation engineering provides that knowledge and teaches students to understand and criticize risks and benefits in this field. This course will enhance the capabilities of students related. to irrigation engineering and canal network. In addition, students will be able to learn fundamentals of drainage and drainage system.

Contents

1. Non-Uniform Flow: Non-uniform flow and its variation with the slope of bed. and shape and size of cross-section. Energy equation for gradually varied. flow, Hydraulic jump.
2. Unsteady Flow: Types of unsteady flow, water hammer, rate of discharge under varying head, compressible fluids in pipes
3. Hydraulic Similitude: Geometric, kinematics and dynamic similarities, physical and numerical models
4. Hydraulic Turbo Machines: Impulse and reaction turbine.
5. Hydraulic pumps (centrifugal and reciprocating): characteristics, Types and working with special reference to deep wells. Selection of pumps
6. Irrigation and Irrigation Structures: Resources of irrigation and discharge measurements. Theories of channel design, lining of channels. Silt control in irrigation canals, silt ejection and uniform distribution. Types of outlets and construction of falls, weirs and barrages, canal head regulator. Canal alignment and cross drainage structures. Types of cross drainage works
7. Irrigation Storage Works: Review of river regulation, reservoir, operation and silting of reservoirs. Analysis and design of gravity dams
8. Water Logging and Drainage: Soil salinity, water logging their environmental impact & assessment. Introduction to Drainage and Drainage system

Recommended Texts

1. Ali, I. (1993). *Irrigation and Hydraulic Structures: Theory, Design and Practice.* (1st Ed.). Pakistan: Institute of Environmental Engineering & Research, NED. University of Engineering & Technology, Karachi

Suggested Readings

1. Piryani, V. B. (1964). *The Fundamentals of Irrigation Engineering.* (1st Ed.). India: Charotar Book

CT-311 Irrigation and Hydraulic Engineering LAB 4 (3+1)

This Lab is divided. into two parts, hydraulics engineering and irrigation engineering. In hydraulics engineering advanced. concepts of fluid mechanics in relation to viscous flows are introduced. It covers laminar flows, transition to turbulence and turbulent flows and will be taught with civil engineering applications in mind. Irrigation engineering takes a special place in the field of water resources engineering as it has the potential to bring economic welfare and food security, but also has the potential to be harmful and destructive. Sound knowledge of the underlying principles and fundamentals is required. to ensure irrigation engineering is practiced. in a sustainable manner. Irrigation engineering provides that knowledge and teaches students to understand and criticize risks and benefits in this field. This lab will enable students to design and study irrigation channels and various hydraulic structures.

Contents

1. Design of channels in alluvial soil
2. Study of canal fall
3. Study of outlet
4. Study of a barrage on pervious foundation
5. Determination of loss of total head in converging and diverging flow.
6. Measurement of velocity with Pitot tube in a closed conduit
7. To determine the discharge in orifice under varying head
8. Study of Hydraulic Jump
9. To study flow channel (by Hydraulic Bench)
12. To study flow over weir (by Hydraulic Bench)
13. Determine the characteristics of Pelton Turbine such as Power, efficiency etc.
14. Determine the characteristics of Francis Turbine such as Power, efficiency etc.
15. Determine the characteristics of Centrifugal pumps.
16. Determine the characteristics of Reciprocating pumps.

Recommended Texts

1. Ali, I. (1993). *Irrigation and Hydraulic Structures: Theory, Design and Practice* (1st Ed.). Pakistan: Institute of Environmental Engineering & Research, NED. University of Engineering & Technology, Karachi

Suggested Readings

1. Piryani, V. B. (1964). *The Fundamentals of Irrigation Engineering* (1st Ed.). India: Charotar Book

CT-312 Reinforced. Concrete Structures 4 (3+1)

Reinforced. Concrete Structure is an introductory design course in civil engineering technology. The course content extends from the revision of properties of fresh and hardened. concrete to the structural design of concrete members. Besides, mechanical properties, durability properties of concrete are also discussed. in the same course. The weakness of concrete in tension is compensated. by reinforcing materials such as steel bars which subsequently combines with stronger characteristic of concrete i.e. compression, to resist the external loads. Reinforcing schemes are generally designed. to resist tensile stresses in particular regions of the concrete that might cause unacceptable cracking and/or structural failure. From the simple beam to slab and further columns and other structural members designs are the constituent of the course. The importance of tensioned. controlled. design considering the intrinsic ductility property of steel bar is also considered. during design, so that lifesaving can be possible in worst case of cracking or failure of structure.

Contents

1. Materials and their properties
2. Mechanical properties of concrete
3. Principles of reinforced concrete
4. Beams, slabs, stairs and columns
5. Reinforcement detailing
6. Introduction to joints

Recommended Texts

1. Hassoun, M. N. & Al-Manaseer, A. (2015). *Structural Concrete: Theory and Design* (6^{th} Ed.). USA: Wiley
2. Nilson, A. H. et al. (2009). *Design of Concrete Structures* (14^{th} Ed.). USA: McGraw Hill

Suggested Readings

1. Wang, C. K. et al. (2006). *Reinforced. Concrete Design* (7^{th} Ed.). USA: Wiley
2. Wight, J. K. & Macgregor, J. G. (2011). *Reinforced. Concrete: Mechanics and design* (6^{th} Ed.). USA: Prentice Hall

CT-312 Reinforced Concrete Structures LAB 4 (3+1)

Reinforced Concrete Structure is an introductory design course in civil engineering technology. The course content extends from the revision of properties of fresh and hardened. concrete to the structural design of concrete members. Besides, mechanical properties, durability properties of concrete are also discussed. in the same course. The weakness of concrete in tension is compensated. by reinforcing materials such as steel bars which subsequently combines with stronger characteristic of concrete i.e. compression, to resist the external loads. Reinforcing schemes are generally designed. to resist tensile stresses in particular regions of the concrete that might cause unacceptable cracking and/or structural failure. From the simple beam to slab and further columns and other structural members designs are the constituent of the course. The importance of tensioned controlled. design considering the intrinsic ductility property of steel bar is also considered. during design, so that lifesaving can be possible in worst case of cracking or failure of structure.

Contents

1. To study the compressive strength of concrete using cube and cylinder
2. To prepare mix design for various strengths of concrete
3. To find workability of concrete using slump cone method, compacting factor method, VeBe time method
4. To study the effect of w/c ratio on the strength of concrete
5. To study effect of aggregate/cement ratio of workability and compressive strength of concrete.
6. To study the permeability of concrete samples with various mix ratio

Recommended Texts

1. Hassoun, M. N. & Al-Manaseer, A. (2015). *Structural Concrete: Theory and Design* (6th Ed.). USA: Wiley
2. Nilson, A. H. et al. (2009). *Design of Concrete Structures* (14th Ed.). USA: McGraw Hill

Suggested Readings

1. Wang, C. K. et al. (2006). *Reinforced. Concrete Design* (7th Ed.). USA: Wiley
2. Wight, J. K. & Macgregor, J. G. (2011). *Reinforced. Concrete: Mechanics and design* (6th Ed.). USA: Prentice Hall

CT-313 **Steel Structures** **3 (3+0)**

This course contains development of understanding of the behavior and design of structural steel members and connections using ASD (Allowable stress design) method along with the behavior and characteristics of structural steel system. The structural design of buildings, whether of structural or reinforced concrete requires the determination of the overall proportions and dimensions of the supporting framework and the selection of the cross sections of individual members. Before any analysis, however, a decision must be made on the primary building material to be used. it will usually be reinforced. concrete, Structural Steel or both. Ideally, alternative designs should be prepared. with each. The emphasis in this course will be on the design of individual structural steel members and their connections. The structural engineer must select and evaluate the overall system in order to produce an efficient and economical design but cannot do so without a thorough understanding of the design of the components (the "building blocks") of the structure. Thus, component design is the focus of this course.

Contents

1. Introduction
2. Tension members
3. Flexural members
4. Compression members
5. Connections
6. New design codes

Recommended Texts

1. Siddiqi, Z. A. et al. (2018). *LRFD Steel Design Aids* (4th Ed.). Pakistan: Help Civil Engineering Publisher.
2. Siddiqi, Z. A. et al. (2005). *Steel Structures* (3rd Ed.). Pakistan: Help Civil Engineering Publisher.

Suggested Readings

1. Salmon, C. G. et al. (2008). *Steel Structures Design & Behavior* (5th Ed.). UK: Pearson.
2. Brockenbrough, R. L. (2019). *Structural Steel Designer's Handbook* (6th Ed.). USA: McGraw Hill.

CT-314 Computer Aided Building Modeling and Design 3 (2+1)

In construction industry, the manual analysis and drafting been replaced. by the computer aided. tools. Cumbersome and laborious manual work which requires costly printing/drawing instruments and a lot of time to analyze, has now become quite easy and interesting computer aided. design and drafting. In view of new era, there is an urgent need. for development of such course which encourages the use of modern tool usage. The aim of this course is to demonstrate the basic tools of computer aided. programs used. for the building modeling and design. This course focuses to produce the capabilities of student to independently prepare the building drawings and develop an ability to analyze and design structures by commercially used. computer packages. After the completion of this course the student will be able to easily use the computer aided. modern tools solving the complex engineering problems, use of different software packages employed. in several Civil Engineering applications

Content

1. Fundamentals of CAD: Introduction, the design process, application of computers for design, creating the manufacturing data base, benefits of CAD Hardware in CAD: The design workstation, graphics terminal, operator input devices, plotters and other output devices, the central processing unit, secondary storage
2. Computer Graphics Software and Data Base: The software configuration of a graphics system, functions of a graphic package, constructing the geometry, data base structure and content, wire-frame versus solid modeling, other CAD features and CAD/CAM integration
3. Mathematical Elements of CAD: Two dimensional transformations, Translation, Scaling, and Rotation, Concatenation, Various techniques for design optimization, finite element analysis / modeling
4. Design Software: Use of different software packages employed in several Civil Engineering applications

Recommended Texts

1. Singh, G. (1983). *Civil Engineering Drawing* (1st Ed.). Pakistan: Standard Publishes.

Suggested Readings

1. Hammad, M. (2017). *AutoCAD 2018 3D Modeling* (1st Ed.). USA: Mercury Learning & Information..

CT-314 **Computer Aided Building Modeling and Design LAB** **3 (2+1)**

In construction industry, the manual analysis and drafting been replaced. by the computer aided. tools. Cumbersome and laborious manual work which requires costly printing/drawing instruments and a lot of time to analyze, has now become quite easy and interesting computer aided. design and drafting. In view of new era, there is an urgent need. for development of such course which encourages the use of modern tool usage. The aim of this lab is to demonstrate the basic tools of computer aided. programs used. for the building modeling and design. This lab focuses to produce the capabilities of student to independently prepare the building drawings and develop an ability to analyze and design structures by commercially used. computer packages. After the completion of this lab the student will be able to easily use the computer aided. modern tools solving the complex engineering problems, Use of different software packages employed. in several Civil Engineering applications

Contents

1. Demonstrate basic concepts of the AutoCAD software
2. Apply basic concepts to develop construction (drawing) techniques
3. Ability to manipulate drawings through editing and plotting techniques
4. Understand geometric construction
5. Produce template drawings
6. Produce 2D Orthographic Projections
7. Understand and demonstrate dimensioning concepts and techniques
8. Understand Section and Auxiliary Views
9. Become familiar with the use of Blocks, Design Center, and Tool Palettes
10. Become familiar with Solid Modeling concepts and techniques.

Recommended Texts

1. Singh, G. (1983). *Civil Engineering Drawing* (1st Ed.). Pakistan: Standard Publishes.

Suggested Readings

1. Hammad, M. (2017). *AutoCAD 2018 3D Modeling* (1st Ed.). USA: Mercury Learning & Information.

CT-315 Water Supply and Waste-Water Management 4 (3+1)

The main aim of this course is the study of water supply and waste water management. Water supply is the provision of water by public utilities, commercial organizations, community endeavors or by individuals, usually via a system of pumps and pipes. Waste-water is water whose physical, chemical or biological properties have been changed. as a result of the introduction of certain substances which render it unsafe for some purposes such as drinking. Day to day activities of man is mainly water dependent and therefore discharge 'waste' into water. It is known that much of water supplies ends up as waste water which make its treatment very important. To ensure a sound environment and good public health waste water treatment is essential to remove most of the contaminants that are found in waste water. Waste water management therefore means handling waste water to protect the environment to ensure public health, economics, social and political soundness.

Contents

1. Introduction: Water supply and wastewater collection systems and their importance with respect to human health, Water borne diseases, Types of impurities and their effects on human
2. Estimation of Water Demand: Water consumption. Components of water consumption, Factors affecting consumption, Fire demand, Variations in demand: average daily consumption, maximum daily consumption and peak hourly consumption, commonly used values of water consumption, Local design guidelines, Design period: factors affecting design period, Population forecasting: mathematical and graphical methods of forecasting population, Population density
3. Source of Water: Ground and surface source, Selection of water sources with respect to quantity and quality considerations
4. Collection and Distribution of Water: Intake structure: reservoir, river and canal intakes, Methods of water distribution, Components and layout of water distribution system. Storage capacity of overhead reservoirs, Use of Hazen William formula, Hardy Cross method, Types of pipes, Pipe joints, service connection, Valves and fire hydrants, Construction of water distribution systems, Disinfections of old and new pipes, Pipes in series and parallel, head losses, major losses, minor losses
5. Estimation of Wastewater Quantities: General considerations, Classification of sewage and sewer systems, Combined and separate sewer systems, Estimation of sanitary sewage quantities, Estimation of storm flow: the rational method runoff coefficients
6. Design of Sewer Systems: Layout of sewers. Sewer appurtenances: manhole drop-manholes and storm water inlets, Design criteria for sanitary and storm sewers, Self-cleansing velocity, Use of Manning's Equation for the design of sanitary and storm sewers, Construction of sewers: types of beddings, joints and laying of sewers, Sewer testing, Sewer cleaning equipment.

Recommended Texts

1. McGhee, T. J. (1991). *Water Supply and Sewerage* (6th Ed.). USA. McGraw Hill
2. Hammer Sr, M. J. & Hammer Jr, M. J. (2011). *Water and Wastewater Technology* (7th Ed.). USA: John Wiley & Sons

Suggested Readings

1. Metcalf & Ed.dy (1981). *Wastewater Engineering: Collection and Pumping of Wastewater* (3rd Ed.). USA: McGraw Hill

CT-315 Water Supply and Waste Water Management LAB 4 (3+1)

The aim of this course is the utilization of theoretical knowledge of Water supply and Waste water management to laboratory work. Water supply is the provision of water by public utilities, commercial organizations, community endeavors or by individuals, usually via a system of pumps and pipes. Waste water is water whose physical, chemical or biological properties have been changed as a result of the introduction of certain substances which render it unsafe for some purposes such as drinking. Day to day activities of man is mainly water dependent and therefore discharge 'waste' into water. It is known that much of water supplies ends up as waste water which make its treatment very important. Waste water management means handling waste water to protect the environment to ensure public health, economics, social and political soundness. This course covers detailed study of population forecasting of various cities using different methods, different types of valves, pipe materials, joints for water supply and sewerage, design of transmission main, water distribution system for a housing scheme, sanitary and storm sewers and preparation of drawings for different bedding of sewers, manholes, drop manholes and storm water inlets.

Contents

1. Forecasting population of various cities using different methods
2. Detailed study of different types of valves
3. Detailed study of different pipe material and joints for water supply and sewerage
4. Design of a transmission main
5. Design of water distribution system for a housing scheme
6. Design of a sanitary sewer system
7. Design of storm sewer system
8. Preparation of drawings for different bedding of sewers
9. Preparation of working drawings for manholes, drop manholes and storm water inlets.

Recommended Texts

1. McGhee, T. J. (1991). *Water Supply and Sewerage* (6th Ed.). USA. McGraw Hill
2. Hammer Sr, M. J. & Hammer Jr, M. J. (2011). *Water and Wastewater Technology* (7th Ed.). USA: John Wiley & Sons

Suggested Readings

1. Metcalf & Eddy (1981). *Wastewater Engineering: Collection and Pumping of Wastewater* (3rd Ed.). USA: McGraw Hill

CT-321 **Environmental Management** **4 (3+1)**

The main aim of this course is to familiarize students with some of the core environmental issues and their management. This course offers a multi-disciplinary understanding of environmental issues and their regulation with the help of engineering tools as well as relevant legislations. It is also meant to help students develop an understanding of the impact human society has, on the environment and our resources and vice versa. It is designed. to develop the knowledge necessary to minimize the damaging impact via regulation of human activities. With the growing focus worldwide on sustainable development, such knowledge of core environmental issues and their management is vital. The course covers a range of relevant topics including concepts related. to the solid waste management system, different kinds of pollution and related. parameters. An introduction to the environmental regulations in Pakistan and to basic concepts of environmental health and safety are also a part of the course.

Contents

1. Introduction to solid waste; classification of solid waste.
2. Collection methods.
3. Transfer and transportation of solid waste; types of equipment.
4. Recycling, reuse and disposal of solid waste.
5. BOD and COD.
6. Introduction to air pollution.
7. Sources of air pollution, its effects, classification and control.
8. Introduction to EIA.
9. Functions of environmental protection council; role of provincial EPAs.
10. Environmental protection act, 1997.
11. National environmental quality standards.
12. Introduction to noise pollution and its mitigation measures.
13. Environmental health and safety.

Recommended Texts

1. Peavy, H. S. et al. (2017). *Environmental Engineering* (1st Ed.). USA: McGraw Hill

Suggested Readings

1. Davis, M. & Cornwell, D. (2012). *Introduction to Environmental Engineering (*5th Ed.). USA: McGraw Hill

CT-321 **Environmental Management LAB** **4 (3+1)**

The main aim of this lab work is to familiarize students with some of the core environmental issues and their management. This course offers a multi-disciplinary understanding of environmental issues and their regulation with the help of engineering tools as well as relevant legislations. It is meant to help students develop an understanding of the impact human society has, on the environment and our resources and vice versa. It is designed. to develop the knowledge necessary to minimize the damaging impact via regulation of human activities. With growing focus worldwide on sustainable development, such knowledge of core environmental issues and their management is vital. The course covers range of relevant topics including concepts related. to the solid waste management system, different kinds of pollution and related. parameters. An introduction to the environmental regulations in Pakistan and to basic concepts of environmental health and safety are also a part of the course.

Contents

1. To determine the Bio-Chemical Oxygen Demand of waste water sample.
2. To determine the amount of suspended solids in drinking water and waste water sample by photometric method
3. To determine the amount of settle able solids in waste sample.
4. To determine the turbidity of continuous flow by Low Range Turbid meter.
5. To determine the amount of volatile suspended solids (MLVSS) in waste water sample by gravimetric method
6. Determination of Oil and Grease by Partition-Gravimetric Method in wastewater
7. Determination of the impact of discharges on the surface water (river, canal etc.).
8. Composition of solid waste (percentage).
9. Energy Value test.
10. Moisture content test.
11. Nox and Sox by hand meters.
12. Carbon monoxide by hand meters.

Recommended Texts

1. Peavy, H. S. et al. (2017). *Environmental Engineering* (1st ed.). USA: McGraw Hill

Suggested Readings

1. Davis, M. & Cornwell, D. (2012). *Introduction to Environmental Engineering (*5th ed.). USA: McGraw Hill

CT-322 Introduction to Earthquake Engineering 3 (2+1)

Introduction to Earthquake Engineering is the fundamental course incorporated. in Civil Engineering Technology curriculum to provide students initial apprehension of earthquake. The course content includes basic theory of earthquake, generation of seismic waves, their propagation, recording and striking any structure, then response of structure to seismic waves and types of motion against the waves. Tectonic Plate Theory is the fundamental theory describing the movement of tectonic plates and their interaction. Strain energy produced. in plates in case of collision, results in seismic waves which propagate inside and outside earth body. The discussion on recording of seismic waves and the responsive forces produced. in a structure subject to the waves is also considered. in the course. Since, this is basic course towards earthquake engineering, therefore, only Single Degree of Freedom (SDOF) is studied. in detail whereas, Multi-Degree of Freedom (MDOF) is only introduced. Moreover, zoning of Pakistan with respect to earthquake is also a small part of the content.

Contents

1. Theory of Tectonic Plate
2. Seismic waves
3. Responsive forces in a structure subject to seismic waves
4. SDOF and MDOF

Recommended Texts

1. Agarwal, P. & Shrihande, M. (2011). *Earthquake resistant design of structures* (1st Ed.). India: PHI

Suggested Readings

1. Charleson, A. (2008). *Seismic Design for Architects* (1st Ed.). USA: Architectural Press

MS-323 **Project Management** **3 (3+0)**

The objective of this course is to understand the basic concepts of management and to learn about organization. These topics teaches the students to understand organization, how people behave in organizations, and the nature of power, influence and leadership. This course help understand concepts of project and project management. This course is specifically designed. for students who will work in construction sector. They will understand project management and its related. concepts in accordance with international standards which will help them to manage a construction project effectively. The aim of this course is also to introduce the students with Oracle Primavera P6 software as a tool for effective planning & scheduling of a project. After completing this subject student will be able to engage in design of temporary structures, coordination of project design, systems design, cost estimating, planning and scheduling, company and project management, materials procurement, equipment selection, and cost control. With the emergence of integrated. project delivery methods such as design-build construction, the role of the engineer is expanding the need. for trained. professionals that understand both aspects of the project delivery environment.

Contents

1. Introduction to Management, Management Functions, Science or Art
2. Managers, Types of Managers, Managerial Skills, Role of Managers.
3. Organization, Types of Organizations, Organizational Design
4. Project, Project Management
5. Project Management Knowledge Areas and Process Groups as per PMBOK
6. Project Life Cycle, Project Network Analysis, Resource Requirements
7. Standard Terminologies for Project Management
8. WBS, OBS, Responsibility Assignment Matrix
9. Project Planning & Scheduling
10. Critical Path Method
11. Earned Value Analysis as project control
12. Introduction of Oracle Primavera P6 software as Planning & Scheduling Software
13. Software Installation, Creating EPS and Project
14. Opening a project and entering Activities
15. Setting Calendar, Creating Resource Pool, Assigning Resources to Activities
16. Resource Leveling, Creating Gantt Chart.

Recommended Texts

1. Mubarak S. (2019). *Construction Project Scheduling & Control* (4th Ed.). USA: John Wiley & Sons
2. PMI. (2017). *A Guide to the Project Management Body of Knowled.ge* (6th Ed.). USA: PMI

Suggested Readings

1. Spinner, M. P. (1991). *Elements of Project Management: Plan, Schedule and Control* (2nd Ed.). UK: Prentice Hall
2. *Oracle Primavera P6 User Guide:* Release 8.3
3. Morse, L. C. & Babcock, D. L. *Managing Engineering and Technology* (6th Ed.). UK: Prentice Hall

Pk. ST-325 **Pakistan Studies** **2 (2+0)**

Develop vision of historical perspective, government, politics, contemporary Pakistan, ideological background of Pakistan. Study the process of governance, national development, issues arising in the modern age and posing challenges to Pakistan. The subject is widely researched in and outside the country, though outside Pakistan it is typically part of a broader South Asian studies or some other wider field. Several universities in Pakistan have departments and research centers dedicated to the subject, whereas many independent research institutes carry out multidisciplinary research on Pakistan Studies. There are also a number of international organizations that are engaged in collaborative teaching, research, and exchange activities on the subject. In Pakistan, the subject is one of the three compulsory courses (along with the Urdu and English language courses) at the Secondary School and Higher Secondary school levels of education. It is also taught as a degree course at most of the Social Science departments in many universities. There are also university departments dedicated to the education and research in Pakistan Studies

Contents

1. *Historical Perspective* , Ideological rationale with special reference to Sir Syed Ahmed Khan, Allama Muhammad Iqbal and Quaid-e-Azam Muhammad Ali Jinnah. Factors leading to Muslim separatism, People and Land, Indus Civilization, Muslim advent, Location and geo-physical features.

2. *Government and Politics in Pakistan Political and constitutional phases:* 1947-58 , 1958-71, 1971-77 , 1977-88 , 1988-99 , 1999 onward

3. *Contemporary Pakistan,* Economic institutions and issues , Society and social structure , Ethnicity, Foreign policy of Pakistan and challenges , Futuristic outlook of Pakistan.

Recommended Texts

1. Burki, S.J. (1980). *State & Society in Pakistan*. UK: The MacMillan Press Ltd
2. Akbar, S. Zaidi. (2000). *Issue in Pakistan's Economy*. Pakistan: Oxford University Press
3. S. M. Burke and Lawrence Ziring.(1993) *Pakistan's Foreign policy: An Historical analysis*. Pakistan: Oxford University Press

Suggested Readings

1. Wilcox, W. (1972). *The Emergence of Bangladesh*. USA: American Enterprise, Institute of Public Policy Research
2. Mehmood, S. (1994). *Pakistan Political Roots & Development.* Pakistan: Oxford University Press

CT-326 **Foundation and Pavement** **4 (3+1)**

This course aims to provide extensive knowledge about different types of foundations and pavements, their design methodologies and characteristics, laying down procedures and problems associated. with them. The course is mainly divided. into two portions. One portion corresponds to foundations of buildings and their different types. This portion deals with engineering parameters associated. with different types of foundations, design of different types of foundations, choice and depth of foundation for any civil work based. upon the external loading. The other portion consists of explanation regarding different types of pavements and their designs. Furthermore, pavement materials, pavement distresses, method of construction of pavements and effect of traffic and other extraneous variable on pavements are discussed. in detail. At the end of this course, students will have better understanding of layout, alignment parameters, design and construction of rigid and flexible pavements. They will also be able to understand typical design of foundations.

Contents

1. Determination of "Flakiness Index" & "Elongation Index" of aggregates
2. Test for angularity no. of aggregate
3. Loss-Angeles Abrasion test on aggregate
4. Determination of viscosity of a given binder using Englers Viscometer
5. Specific gravity and water absorption test
6. Penetration test on asphalt
7. Ductility test on asphalt
8. Determination of softening point of bitumen
9. Determination of flash point of a sample of bitumen
10. Marshall Stability test
11. CBR test
12. Boring log with SPT values up to 30 ft

Recommended Texts

1. Bowles, J. E. (1995). *Foundation Analysis and Design* (5th Ed.). USA: McGraw Hill

Suggested Readings

1. Huang, Y. H. (2003). *Pavement Analysis & Design* (2nd Ed.). UK: Prentice Hall
2. Peck, R. B. et al. (1974). *Foundation Engineering* (2nd Ed.). USA: John Willey & Sons

CT-326 **Foundation and Pavement LAB** **4 (3+1)**

The aim of this lab is to cover all such experiments that are related. to the engineering properties of pavements and foundations. Testing of materials being used. for pavements and foundations and their properties in-place are considered. as essential information for road construction and repair respectively. Similarly, knowledge of bearing capacity, California bearing ratio and density of foundation helps in laying the super structure effectively. This lab particularly focuses on the above-mentioned. parameters and involves such experimentation that directly provides information about these parameters. As a whole, this lab work is designed. to get an overall know how about the engineering parameters required. to judge the suitability of foundations and pavements. Not only to judge them but also to interpret these parameters wherever needed Performance of these experiments will enhance the psychomotor skills of students apart from their understanding and interpretation of resultant engineering parameters and Foundations, contact pressure, allowable bearing capacity, total, differential and permissible settlements

Content

1. Foundations, contact pressure, allowable bearing capacity, total, differential and permissible settlements
2. Foundation types e.g. shallow and deep foundations
3. Foundation design, geotechnical and structural design
4. Shallow foundations
5. Deep foundations
6. Lateral earth pressure and retaining walls
7. Highway loads, AASHTO loads, Axle loads
8. Pavement Design, types of pavements and their design
9. Construction details, methods of construction, climate and traffic effects, recycling of existing roads

Recommended Texts

1. Bowles, J. E. (1995). *Foundation Analysis and Design* (5th Ed.). USA: McGraw Hill

Suggested Readings

1. Huang, Y. H. (2003). *Pavement Analysis & Design* (2nd Ed.). UK: Prentice Hall
2. Peck, R. B. et al. (1974). *Foundation Engineering* (2nd Ed.). USA: John Willey & Sons

CT-421 **Supervised Industrial Training** **16 (0+16)**

The students need. to have industry and workshop exposure, where they can experience real life equipment, materials, instruments and various kinds of Metallurgical Process & related. Equipment's this course has been designed. for the students to have real life experiences to help them prepare for their career. The objectives of the Industrial Training include: To give students the opportunity to apply the knowledge and skills they have acquired. on campus in a real-life work situation. To provide students with opportunities for practical, hands-on learning from practitioners in the students' areas of specialization. To expose students to a work environment, common practices, employment opportunities and work ethics in their relevant field. To enhance the employability skills of the students. To provide opportunities for students to be offered. jobs in the organizations in which they undergo their Industrial Training.

Upon completion of these trainings, students are expected. to demonstrate the following graduates' attributes:

Contents

1. Engineering Knowled.ge
2. Problem analysis
3. Design/development of solutions
4. Conduct investigations of complex problems
5. Modern tool usage
6. Individual and Team Work
7. Communication and Project Management

BS

MECHANICAL ENGINEERING TECHNOLOGY

MATH-111 **Applied. Mathematics-I** **3 (3+0)**

The main aim of this course is to review the knowledge and practice the skills acquired in diploma Courses and understand the concept and use of differential equations. To learn different methods to solve differential equations and understand the concept of complex numbers and their applications. Basic calculus in which matrices and determinants would be involved will be practiced. Introduction to Differential Equations Basic Concepts in which linear first order differential equation and, Bernoulli's Differential Equations and the equations related to them would be discussed. Higher Order Differential Equations means second order differential equations will be involved. Partial differential equations will also be practiced. At the end complex numbers would be studied. and operations related to them would be solved. In this way students' analytical skills will be improved to a great extent. After solving these complex problems students would have a firm grip on problem solving which plays a very important role from design point of view in engineering field.

Contents

1. Review of the following: Integral Calculus, Differential Calculus Matrices and Determinant, Vector Algebra and Analytical Geometry.
2. Introduction to Differential Equations Basic Concepts: Geometric Interpretations, Separable Equations, Exact Differential Equations, Linear First Order Differential Equations, Bernoulli's Differential Equations, Families of Curves, Applications.
3. Higher Order Differential Equations: Homogeneous Linear Equations of Second Order, Non-Homogeneous equations, Application of Higher Linear Differential Equations.
4. Partial Differential Equations: Basic Concepts, Solution by Separable Variables, Classification
5. Complex Numbers: Invented Number Systems, The Argand Diagram, Complex Variables, Derivatives, Complex Series, Applications

Recommended Texts

1. Murphy H. A., Hildebrandt H. W. and Thomas J.P. (2001). *Effective Business Communications*. USA: McGraw-Hill.

Suggested Readings

1. T Norman S. (2010). *We're in Business*. UK: Longman Group Ltd.
2. Thomson A. J. and Martinet A. V. *A (1993). Practical English Grammar*. Oxford: Oxford University Press

CS-112 **Computer Applications** **2 (2+0)**

The main aim of this course is to review the knowledge and practice the skills acquired in diploma Courses and practice the use of BASIC language and Spreadsheet software in different applications. To learn the concept of CAD/CAM and related application and familiarization with commercially available software's in the relevant field. Electronic data processing would be carried out. Character and paragraph formatting which is done is MS-Word would be focused. Page Setup and Print Setup would be practiced. Entering and editing data, general calculations in spread sheets would be carried out. Applications of CAD and CAM would be discussed in detail. Familiarization with Commercially available Software's In the relevant field would be done. So, the main aim of this course is to equip the students with the use of computer in word, spreadsheet and in other basic software's so that they can use the computer system in any industry effectively.

Contents

1. Electronic Data Processing.
2. Operating System.
3. BASIC language.
4. Character and Paragraph Formatting in MS-Word.
5. Tables and Columns in MS-Word.
6. Page Setup and Print Setup in MS-Word.
7. Inserting Objects Styles.
8. Index and TOC Customization.
9. Data Types.
10. Entering and ed.iting data General Calculations in Spreadsheets.
11. Statistical Analysis in spread sheets.
12. Graphics.
13. CAD/CAM Applications.
14. Familiarization with Commercially available Software's In the relevant field.

Recommended Texts

1. Gottfried. R. S. (1980). *Programming with Basic*. Schaum's Outline Series. USA: McGraw Hill.
2 . Tucker A. B., Bernat A., Cupper R. D. and Scragg G. W. (2017). *Fundamentals of Computing*. USA: McGraw Hill book company.

Suggested. Readings

1. Bradley J. C. (2017) *Quick basic*. USA: Brown Publishers.

ENG-113 **Communication Skills-I** **3 (3+0)**

The aim of the course is to enhance the productive as well as receptive skills of the students so that they can use the language efficiently in academic and real-life situations in such a manner that they can develop reliable communicative competence. This course also aims to train students in acquiring all the study skills required to cope efficiently not only with the students' challenges of the English language but also with the demands of other subjects written in the English language which need to be dealt with at optimal level of efficiency. Study skills equip the students with the required inventory to explore as well as utilize the resources in academic and professional environment. This course helps them to develop compatibility with the learning environment within the classroom and at the same time enhances communication stability outside the classroom. The course also helps the students to develop aesthetics of language appreciation.

Contents

1. Introduction to Communication Importance, Theories, Barriers, Components.
2. The Seven C's for Effective Communication.
3. Listening Skills Blocks, Thinking and Feeling Notes Taking, Giving Feedback.
4. Reading Skills Active Reading Techniques, Skimming, General Reading and Careful Reading.
5. Introduction to Writing Skills Planning, Drafting and editing Emphasis and Connections.
6. Grammar and Vocabulary Technical and Business Vocabulary, Constructing Formal Sentence.

Recommended Texts

1. Murphy H. A., Hildebrandt H. W. and Thomas J.P. (2001). *Effective Business Communications*. USA: McGraw-Hill.

Suggested Readings

1. T Norman S. (2010). *We're in Business*. UK: Longman Group Ltd.
2. Thomson A. J. and Martinet A. V. *A (1993). Practical English Grammar*. Oxford: Oxford University Press.

MT-114 **Applied. Physics** **4 (3+1)**

The main aim of this course is to learn scientific notation and significant figures. Unit in different systems. Different basic concepts like vectors and mechanics would be explained. Concepts like Coordinate systems. Motion under constant acceleration, Newton laws and their applications, Uniform circular motion would be refreshed after studying this course. Electrostatic and magnetism which is a very wide topic and covers the concepts like Coulombs law. Gauss's law. Electric field around conductors. Dielectrics. Magnetic fields. Magnetic force on current. Semiconductor Physics: Energy levels in a semiconductor, Hole concept, Intrinsic and extrinsic regions, Law of mass action, P-N junction, Transistor would be studied in detail. Waves and Oscillation would be discussed, and optics and laser section would be covered. Modern Physics which includes topics like Photoelectric effect, Compton effect. Bohr theory of hydrogen atom, atomic spectra, reduce mass, De-Broglie hypothesis Braggs law, electron microscope, Zeeman effect, atomic nucleus, mass energy relation, binding energy, nuclear forces and fundamental forces. Exponential decay and half-life would be studied.

Contents

1. Vectors: Review of vectors, Vector derivatives, Line and surface integrals, Gradient of scalar. Mechanics: Coordinate systems. Motion under constant acceleration, Newton laws and their applications, Uniform circular motion. Vortex Motion, Frictional forces. Work and energy. Potential energy, energy conservation, energy and our environment.
2. Electrostatic and magnetism: Coulombs law. Gauss's law. Electric field around conductors. Dielectrics. Magnetic fields. Magnetic force on current. Semiconductor Physics: Energy levels in a semiconductor. Hole concept. Intrinsic and extrinsic regions. Law of mass action. P-N junction. Transistor.
3. Waves and Oscillation: Free oscillation of systems with one degree of freedom. Classical wave equation. Transverse modes for continuous string. Standing waves. Dispersion relation for waves.
4. Optics and Laser: Basic introduction to Optics and Laser. Diffraction grating. Lasers, population inversion. Resonant cavities. Quantum efficiency. He-Ne, Ruby and CO2 lasers. Doppler effect and sonic boom.
5. Modern Physics: Photoelectric effect, Compton effect. Bohr theory of hydrogen atom, atomic spectra, reduce mass, De-Broglie hypothesis Braggs law, electron microscope, Zeeman effect, atomic nucleus, mass energy relation, binding energy, nuclear forces and fundamental forces. Exponential decay and half-life

Recommended Texts

1. David Halliday R. Resnick. (2010). *Physics.* USA: McGraw-Hill.

MT-115 **Engineering Drawing** **3 (1+2)**

The main aim of this course is to clear basic concepts of technically drawing various engineering parts. After studying this course students would be able to know about different types of projections and drawings. Starting from lettering and use of pencils and drawing instruments to the proper technical drawing will be covered in this course. Plane of projections and four quadrants would be emphasized. Projection of oblique and auxiliary planes practice would be carried out. Making of loci of points and straight lines would be practiced along with the explanation of types of solids. Projection of various solids in simple position and inclined position would be carried out. Isometric and pictorial projections of solids/machine parts from where major drawings are made would be carried out. True shape of section on auxiliary plane of various solids would be made. Making of freehand sketches from solid objects and from orthographic projections would be practiced. Practice of introduction to computer aided engineering drawing and use of software/package will be made.

Contents

1. Types of lines.
2. Lettering.
3. Dimensioning.
4. Use of pencil and drawing instruments.
5. Types of projections.
6. Orthographic projections.
7. Plane of projections and four quadrants.
8. Projection of oblique and auxiliary planes.
9. Loci of points and straight lines.
10. Types of solids.
11. solids of revolution.
12. Intersection of cylinder and cylinder.
13. Projection of various solids in simple position and inclined position.
14. True shape of section on auxiliary plane of various solids.
15. Isometric and pictorial projections of solids/machine parts.
16. Making of freehand sketches from solid objects and from orthographic projections.
17. Introduction to computer aided engineering drawing and use of software/package.
18.

Recommended Texts

1. Bertoline Wiebe, Miller, Mohler, Irwin. (1997). *Technical Graphics Communication*. USA: McGraw-Hill.
2. Abbot. (2013). *Practical Geometry and Engineering Graphics.*UK: Longman Group Ltd.

Suggested Readings

1. Gary R. Bertoline and Eric N.(2005). Wiebe .*Technical Graphics Communication* (3rd ed.). UK: Longman Group Ltd.
2. D.F. Rogers and J.A. Adams (1976) .*Mathematical Elements for Computer Graphics*. Oxford: Oxford University Press

ISL-116 **Islamic Studies** **2 (2+0)**

The main aim of this course is to provide Basic information about Islamic Studies and enhance understanding of the students regarding Islamic Civilization. To improve Students skill to perform prayers and enhance the skill of the students for understanding of issues related to religious life. Introduction to Quranic Studies is involved in this course. Seerat of our beloved Holy Prophet (S.A.W) is explained. Introduction to Sunnah: Basic Concepts of Hadith, History of Hadith, Kinds of Hadith, Uloom –ul-Hadith, Sunnah & Hadith, Legal Position of Sunnah will be explained. Islamic Culture & Civilization: Basic Concepts of Islamic Culture & Civilization, Historical Development of Islamic Culture & Civilization, Characteristics of Islamic Culture & Civilization, Islamic Culture & Civilization and Contemporary Issues will also be part of this course. Knowledge about Social System of Islam.

Contents

1. Introduction to Quranic Studies: Basic Concepts of Quran, History of Quran, Uloom-ul –Quran
2. Study of Selected. Text of Holly Quran:Verses of Surah Al-Baqra Related. to Faith(Verse No-284-286), Verses of Surah Al-Hujrat Related. to Adab Al-Nabi (Verse No-1-18), Verses of Surah Al-Mumanoon Related. to Characteristics of faithful (Verse No-1-11), Verses of Surah al-Furqan Related. to Social Ethics (Verse No.63-77), Verses of Surah Al-Inam Related. to Ihkam(Verse No-152-154) and Study of Selected. Text of Holly Quran: Verses of Surah Al-Ihzab Related. to Adab al-Nabi (Verse No.6,21,40,56,57,58.), Verses of Surah Al-Hashar (18,19,20) Related. to thinking, Day of Judgment, Verses of Surah Al-Saf Related. to Tafakar,Tadabar (Verse No-1,14)
3. Seerat of Holy Prophet (S.A.W) –I: Life of Muhammad Bin Abdullah (Before Prophet Hood), Life of Holy Prophet (S.A.W) in Makkah, Important Lessons Derived. from the life of Holy Prophet in Makkah and Seerat of Holy Prophet (S.A.W) –II: Life of Holy Prophet (S.A.W) in Madina, Important Events of Life Holy Prophet in Madina. Important Lessons Derived. from the life of Holy Prophet in Madina and Introduction to Sunnah: Basic Concepts of Hadith, History of Hadith, Kinds of Hadith, Uloom –ul-Hadith, Sunnah & Hadith, Legal Position of Sunnah and Selected. Study from Text of Hadith Introduction to Islamic Law & Jurisprudence: Basic Concepts of Islamic Law & Jurisprudence, History & Importance of Islamic Law & Jurisprudence, Sources of Islamic Law & Jurisprudence, Nature of Differences in Islamic Law, Islam and Sectarianism
4. Islamic Culture & Civilization: Basic Concepts of Islamic Culture & Civilization, Historical Development of Islamic Culture & Civilization, Characteristics of Islamic Culture & Civilization, Islamic Culture & Civilization and Contemporary Issues and Islam & Science: Basic Concepts of Islam & Science, Contributions of Muslims in the Development of Science, Quranic & Science
5. Islamic Economic System: Basic Concepts of Islamic Economic System, Means of Distribution of wealth in Islamic Economics, Islamic Concept of Riba, Islamic Ways of Trade & Commerce
6. Political System of Islam: Basic Concepts of Islamic Political System, Islamic Concept of Sovereignty, Basic Institutions of Govt. in Islam and Islamic History: Period of Khlaft-E-Rashida, Period of Ummayyads, Period of Abbasids and Social System of Islam: Basic Concepts of Social System of Islam, Elements of Family, Ethical Values of Islam.

Recommended Texts

1. Hameed. ullah Muhammad.(1999). *Emergence of Islam*. Islamabad: IRI.
2. Hameed. ullah Muhammad(2012). *Muslim Conduct of State*. Islamabad: IRI.

MT-114 **Machining Process** **2 (1+1)**

In this course, students will learn different cutting tool materials and different cutting fluids used during the machining process. This course will train the students in the metal cutting domain so as to equip them with adequate knowledge about the various processes like turning, shaping, planning, drilling, milling and grinding. To emphasize upon the prominent theories, concepts and constructional features of machines related to them. In this course students will also learn about the different types of threads, their types and uses. This course will provide an insight about the super finishing operations of lapping and honing. At the end of the course, the students will be to identify the selection of processes, analyze surface properties after machining without destructing the material, match the material and tool with respect to process and explain the basic principle of conventional machining process.

Contents

1. Cutting Tool Materials and Cutting fluids: Steels, Carbides, Carbides Coated Tools, Ceramics, Diamond tools, abrasives, Cutting Fluids properties, purposes and their types.
2. Lathe Operations: Turning parameters, further work on lathe machines i.e. eccentric and form turning, under cutting, center hole, Calculation of MMR, Power and Cutting Time, High Precision Machining, Hard Turning, Cutting Screw Threads (single, double and triple start), Lathe accessories and attachments, Semi-Automatics and automatics. Milling Operations, Milling parameters, Calculations of MMR, power and Cutting Time, Milling attachments, Accessories, Copy Milling, Die Sinking, and Index Milling.
3. Planning, Shaping and Broaching Operations: Principle, Tools, applications
4. Gear Manufacturing: Machining, Form Cutting, Shaping, Hobbling
5. Finishing Operations: Grinding, Honing, Lapping, Polishing and Buffing

Recommended Texts

1 W A J Chapman. (2018) W*orkshop technology* (Part I, II, III). UK: Prentice Hall.
2 SK Hajra Choudhury. (1978) *Elements of workshop technology machine tools.* Oxford: Oxford University Press.

Suggested Readings

1 Genevro W A J and Heineman S S. (1991) *Machine tools: processes and applications*. UK: Prentice Hall.
2 Kibbe R R Neely J E Neyer R O and White W T. (2009) *Machine tool practice*. UK: Prentice Hall.

MATH-122 Mathematics-2 3 (3+0)

This course includes the study of first order differential equations, higher order linear differential equations, Laplace transforms, numerical methods, boundary value and initial value problems, qualitative analysis of solutions, and applications of differential in solving engineering problems. Differential equation basic concepts and ideas would be involved like geometrical interpretation of first and second order differential equations (D.E). Linear first order differential equations and Bernoulli's differential equation would be studied. Families of curves, orthogonal trajectories, and applications of differential equations of first order to relevant engineering systems would be analyzed Study of Cauchy equation will be carried out and Applications of higher order linear differential equations would be discussed. Simple Sequences and Series operations would also be studied. Complex and repeated roots of characteristics equations would also be emphasized. Topic of Ordinary and regular points and corresponding series solutions will also be observed. After solving problems related to these topics students' analytical skills would be maximized.

Contents

1. Differential equation; basic concepts and ideas; geometrical interpretation of first and second order differential equations (D.E)
2. Separable equations, Reducible to Separable form,
3. Exact D. E, integrated factors
4. Linear first order differential equations, Bernoulli's differential equation.
5. Families of curves, orthogonal trajectories, and applications of differential equations of first order to relevant engineering systems
6. Homogeneous linear differential equations of second order
7. Homogeneous equations with constant coefficients, the general solutions
8. Initial and boundary value problems, D- operator
9. complementary functions, and particular integrals. Real
10. complex and repeated roots of characteristics equations
11. Cauchy equation,
12. non-homogeneous linear equations.
13. Applications of higher order linear differential equations.
14. Ordinary and regular points and corresponding series solutions
15. Sequences
16. Series

Recommended Texts

1. Barrett, L. C., & Wylie, C. R. (1960). Advanced. engineering mathematics. USA: McGraw Hill ed.ucation.
2. A Kreyszig, E. (2009). Advanced. Engineering Mathematics. New Jersey: John Wiley & Sons.

Suggested Readings

1. Arfken, G. B., & Weber, H. J. (2012). Mathematical methods for physicists. India: Elsevier

HU-215 **Communication Skills-II** **2 (2+0)**

The aim of the course is to enhance the productive as well as receptive skills of the students so that they can use the language efficiently in academic and real-life situations in such a manner that they can develop reliable communicative competence. This course also aims to train students in acquiring all the study skills required to cope efficiently not only with the students' challenges of the English language but also with the demands of other subjects written in the English language which need to be dealt with at optimal level of efficiency. Study skills equip the students with the required inventory to explore as well as utilize the resources in academic and professional environment. This course helps them to develop compatibility with the learning environment within the classroom and at the same time enhances communication stability outside the classroom. The course also helps the students to develop aesthetics of language appreciation.

Contents

1. Communication Environment: Organizational Structure, International Communication, Nondiscriminatory Communication, Communication Channels.
2. Communication and Technology: Presentation Graphics and Word Processing, Fax, E-mail, Internet and Voice Mail, CD-ROM and Online Databases, Teleconferencing, Audio Visual Aids.
3. Presentation Skills: Defining objective, audience analysis, style and tone, credibility, opening, closing and main ideas, use of Audio-Visual Aids.
4. Meetings and Interviews: Participating in Meetings, chairing a Meeting, Asking and Answering Questions in Meetings, Preparing Resumes, Preparing for Interviews, Asking and Answering Questions in Interviews.
5. Letters and Memos: Formats, Positive and Negative Messages, Persuasive Communication, Requests.
6. Technical Report Writing: Introduction and Importance, General Formats, Short and Long Reports, Proposals, Quoting References.

Recommended Texts

1. Murphy H. A., Hildebrandt, H. W. and Thomas J.P. (2001). *Effective Business Communications*. USA: McGraw Hill.
2. Morrisey G.L., Sechrest T.L. and Warman W.B. (1997). *Loud and clear*. Addison-Wesley USA: Publishing Company.

Suggested Readings

1. Beebe S.A. and Beebe S.J.(2007). *Public speaking*. USA: Allyn and Bacon.

MT-124 **Industrial Materials** **3 (3+0)**

The main aim of this course is the study different industrial materials. At the end of the course students would be able to have a clear concept of crystal geometry, materials composition properties and substitution. The course majorly emphasizes on the basic heat treatment processes which include annealing, galvanizing, hardening, tempering and also on the effect of the alloying elements on the mechanical properties of the steel. A major portion for nonferrous metals would also be included in which fundamental concepts of non-ferrous metals and their common heat treatment processes would be under discussion. The application of nonmetals like plastics, ceramics, glass and rubber which plays a very Vitol role in the different industrial manufacturing processes would be thoroughly studied and their scope will be described. So basically, industrial materials covered two main sections metal and non-metals including their basic concepts, properties, industrial usage or applications and different industrial processes related to them.

Contents

1. Concept of crystal geometry.
2. Crystalline structure of metals.
3. BCC, FCC and HCP structure.
4. formation of alloys (binary alloys, phase diagram of binary alloys).
5. Phase diagram of binary alloys, cooling curves, solid solution, eutectic alloy, intermediate compounds
6. Properties of plain carbon steel.
7. Heat treatment processes (Annealing, Normalizing, Hardening, Tempering).
8. Effect of alloying elements on mechanical properties of steel, Cast Irons, Gray Cast iron, White Cast Iron and Malleable cast Iron, Non-ferrous Metals and alloys.
9. Mechanical properties of copper and aluminum, copper zinc and copper tin alloys.
10. Composite Materials and their applications.
11. Polymers and its types
12. Polymerization applications

Recommended Texts

1. V John. (2010). *Introduction to Engineering Materials*. USA: Addison-Wesley Publishing Company.
2. Degarmo Black & Kohscr Amstead (2012). *Materials and Processes in Manufacturing*. USA: McGraw Hill.

Suggested Readings

1. Ostwald & Begeman. (2015). *Manufacturing Process*. USA: McGraw Hill.
2. Avner. (1997) Introduction *to Physical metallurgy.* USA: Allyn and Bacon.

MT-125 **Applied. Mechanics** **4 (3+1)**

Upon successful completion of the course, the student will be able to learn the concepts of vectors and scalars, forces, moments and couples and then apply the learned concepts of forces, moments and couples to solve problems of equilibrium in 2-D and 3- D. Analyze structures such as plain trusses, frames and machines for reaction forces and then apply the concepts of mechanics to solve problems of friction. Mechanics basic concepts which includes Scalar and vector, Vector addition, subtraction and product, concept and unit of measurements of mass, force, time, space would be discussed. Equilibrium conditions including Equilibrium in two dimensions, Equilibrium conditions, Free body diagram, Solution of problems would be discussed. Geometrical properties of plane area including introduction, center of gravity and centroid, moment of inertia for an area, parallel – axis theorem for an area, radius of gyration of an area, solution of problems would be also observed in this course.

Contents

1. Introduction to statics: Mechanics: Basic concepts; Scalar and vector; Vector addition, subtraction and product, concept and unit of measurements of mass, force, time, space
2. Force system: Force: Introduction; Two-dimensional force system; Rectangular components; Law of triangle, parallelogram, moment, couple, resultants; solution of problems
3. Equilibrium: Equilibrium in two dimensions; Equilibrium conditions; Free body diagram; solution of problems.
4. Beams: Definition; Types of beams; Bending moment and shearing force in simply supported beams and cantilevers; Solution of problems.
5. Geometrical properties of plane area: Introduction; Center of gravity and centroid; Moment of inertia for an area; Parallel – Axis theorem for an area; Radius of gyration of an area; Solution of problems
6. Kinematics of rectilinear and curvilinear motion: Introduction; Displacement; Types of motion; Speed., velocity, acceleration; Equation of motion under uniform acceleration; Normal and tangent acceleration. Solution of problems
7. Friction: Introduction; Types of friction; Laws of solid friction; Coefficient of friction; Solution of problems
8. Work and energy: Work, Energy, Power, Impulse; Momentum; Simple harmonic motion and free vibration. Introduction to simple trusses and cables. Solution of problems.

Recommended Texts

1. Hibbeler, R. C. (2013). Engineering Mechanics- Statics and Dynamics (13th ed.). NY: Prentice Hall.
2. J L Meriam, L G Kraig, (2007). *Engineering Mechanics (Statics)*. Hoboken: John Wiley & Sons Inc.

Suggested Readings

1. Kleppner, D., & Kolenkow, R. (2014). An introduction to mechanics. Cambridge: Cambridge University Press.
2. E. Nelson, (2010). *Engineering Mechanics Statics*. NY: Schaum's outline series.

MT-126 **Computer Aided. Drafting** **2 (1+1)**

The main aim of this course is to study two different software i.e. Auto Cad and Pro Engineer wildfire for 2D and 3D drawings. At the end of the course students will be able to understand different techniques used for drawing in 2D and 3D for this software. The course majorly emphasis on the learning of primitives of software, solid modeling, surface modeling, wire frame modeling, creating and assembling of mechanical parts. This software allows student to produce accurate drawings quickly and to save, revisit, edit, and print them and streamlining the workflow. Today, the use of CAD has permeated almost all industries. From aerospace, electronics to manufacturing, CAD is used. in all industry verticals. Since CAD encourages creativity and speeds up productivity, it is becoming more and more useful as an important tool for visualization before actually implementing a manufacturing process. That is also one of the reasons CAD training is gaining more and more importance.

Contents

1. Introduction to AutoCAD (Latest version available), AutoCAD interface, toolbars, Menus, Coordinate System, and AutoCAD commands uses for creating organizing modifying saving & plotting 2D drawings
2. Drawing in layers, object properties, hatching, text dimensioning, blocks, attributes, external reference, auto cad design center
3. Introduction to 3D modeling, solid modeling, surface modeling & wire frame modeling. Extrude, Revolve, Union, Subtract, Intersect & other 3D commands, 3D view, view ports, model space, paper space & layouts
4. Introduction to product design. Basic concepts in product designing using pro engineering software (feature – based) parametric solid modeling
5. Creating simple mechanical parts
6. Assembling simple mechanical parts
7. Generating 2D drawings of the parts & assemblies

Recommended Texts

1. Omura, G. (2012). *AutoCAD user guide*. Hoboken: John Wiley & Sons Inc publications.

MT-211 **Mechanics of Materials** **4 (3+1)**

The main aim of this course is to review enable the students to understand application of forces & their effects on different mechanical & structural members in statics & Dynamics. After studying this course students would be able to have a sound knowledge to understand different mechanical properties of the materials. Different types of stresses including tensile, compressive and shear would be investigated, and shear strain will be calculated. Detailed study of thermal stresses would be carried out. Moment of inertia in different bodies would be calculated using different methods. Shearing forces and bending moment will be calculated in the bars and also torsion of circular bars would be analyzed. Article of hollow circular shafts would be derived and strain energy will also be analyzed. So basically, after studying this course the students would have enough grip on the design calculations and they would apply various theories for the proper checking of the bodies before failure occurs.

Contents

1. Mechanical properties of Materials.
2. Tensile, compression and shear stress and shear strain
3. Elastic constants and their relationships.
4. Compound bars.
5. Thermal stresses.
6. Moments of inertia.
7. Shearing force and bending moment.
8. Torsion of circular bars.
9. Hollow circular shafts.
10. Strain Energy.

Recommended Texts

1. F.P Beer & ER Johnston. (2004). *Mechanics of materials*. USA: Tata MaGraw Hill education publisher.
2. FV Warnock P.P Benham & R.J Crawford. (2002) *Mechanics of engg materials*. USA: Tata MaGraw Hill education publisher.

Suggested Readings.

1. F.Singar. (2013). *Strength of Materials*. USA: John Wiley & Sons Inc publications.

MT-212 **Applied. Thermodynamics** **4 (3+1)**

The main aim of this course is to clear basic concepts of thermodynamics and to make student understand its practical applications. After studying this course students would be able to know open and closed. systems, processes and cycles of these systems, Carnot cycle and heat engine and refrigerator. The laws of Thermodynamic and their application to engineering thermodynamic systems would be explained. briefly. Engines, Air Compressors, Steam Engines. Entropy, irreversibility application to heat engine will be analyzed. and practical problems related to them would be solved. Turbines, Air standard Efficiency, Thermal and mechanical efficiency. Air fuel ratio, octane number and cetane number which plays a very critical role in especially automobile industry will be fully emphasized. Other than this practical application of the applied. Thermodynamics will be considered. and explained. So, students after the completion of this course would be able to analyze the them science problems involved. in various mechanism and could practically solve them.

Contents

1. Basic concepts of thermodynamics (Thermodynamics and energy)
2. Closed and open system
3. Properties of a system
4. State and equilibrium
5. Processes and cycles
6. Pressure and its measuring instruments
7. Pure substance and its phase change process
8. Property diagram
9. Internal energy and specific heat
10. Enthalpy and specific heats of ideal gases
11. Energy transfer by work
12. Flow work and energy of the flowing fluid
13. Modes of heat transfer
14. First law of thermodynamics
15. Energy balance for closed., Systems and for steady flow systems
16. Second law of thermodynamics
17. Refrigeration and heat pumps.
18. Carnot cycle and its principles.
19. Definition and description of entropy.

Recommended Texts

1. Rayner Joel. (1996). *Basic engineering Thermodynamic*. USA: John Wiley & Sons Inc publications.

Suggested Readings

1. Youns A Cengel and Michael A Boles. (2004). *Thermodynamics an engg approach.* USA: Tata MaGraw Hill education.

MT-213 Production Planning and Control 3 (2+1)

After studying this course students would be able to have a sound knowledge to understand skills in forecasting, inventory control, JIT and new concepts in production planning. Proper forecasting approaches including its different types would be under discussion. Terms like inventory systems and economic lot size would be explained. Students would become well aware with significance of purchasing strategies, purchasing management and materials management. Master production schedule used in high level industries will be discussed and terms like MRP Management and Job Shop Scheduling would be explained. Sequencing line balancing and shop loading would be analyzed. Queuing Theory basics would be explained, and students would become aware with its characteristics and models. In short it will be a detailed theory and experimentation to make the students well that how production mechanism with a significant control is to be carried in the industries so they are equipped with these Vitol skills when they practically enter in their fields.

Contents

1. Introduction, Forecasting Approaches, Time Series Forecasting Techniques, Casual Forecasting Techniques, Role of Computer in Forecasting.
2. Inventory Systems
3. Economic Lot Size
4. Quantity Discounts and Safety Stock Level.
5. JIT Production and Kanban.
6. Significance of purchasing strategies.
7. Purchasing Management and Materials Management.
8. Master Production Schedule.
9. Bill of Materials and Resource Requirements.
10. MRP Management.
11. Job Shop Scheduling.
12. Shop Loading.
13. Sequencing, Line balancing.
14. Introduction to Queuing Theory.
15. Queue Characteristics and models.

Recommended Texts

1 Render B and Heizer J. (2005). *Principles of operations management*. USA: Prentice-Hall, Inc.
2 Littlechild S. (2013). *Operations research in management.* UK: Prentice Hall.

Suggested Readings

1. Tersine R J. (2002). Principles of inventory and materials management. UK: Prentice Hall.
2. Adam E E and Eber R J. (2015) *production and operations management*. UK: Prentice Hall.

MT-214 Basic electrical technology 4 (3+1)

The main aim of this course is to clear basic concepts of electrical equipment's which are mostly and mainly used. Students after the study of this course would be able to have a sound knowledge about insulators, semiconductors and metals and how they are used in electrical technology. PN junction diode would be studied and applied in various cases for the analyzation of electrical current. Transistors would also be highly focused. Amplifiers basic principles would be explained. Integrated circuits for industrial control will be judged. Working of instruments like oscilloscopes and signal generators will be seen. Brief introduction to microprocessors and micro controllers will be explained. Basic I/O devices will be told. So, as a summary of this subject will be as the name shows about basic electrical technology and the working of main components involved in it. So, after the completion of this course it would be easy for the students to understand that how different electrical equipment's are used in industry.

Contents

1. Insulators.
2. Semiconductors.
3. Metals.
4. PN junction diode.
5. Rectifier circuits.
6. Transistors.
7. Constructions and characteristics of bipolar junction transistor (BJT).
8. Construction and characteristics of FET.
9. Amplifiers basic principles.
10. Integrated circuits.
11. Integrated circuits for industrial controls.
12. Construction and working of digital multi-meters.
13. Oscilloscopes.
14. Signal generators.
15. Combinational logic design.
16. Introduction to microprocessors and micro controllers.
17. I/O devices.

Recommended Texts

1. Floyd. (2002) *Electronic devices. UK:* McGraw Hill.
2. *R.* Tokhem. (2012) *Microprocessor fundamentals.* USA: Prentice Hall, Inc.

Suggested Readings

1. Floyd Digital (2005). *Electronics.* USA: Prentice-Hall, Inc.
2. Chute. (2000) *Electronics in Industry* UK: McGraw Hill.

MT-221 **Machine Design** **4 (3+1)**

After studying this course students would be able to analyze stresses developed in various machine parts subjected to different loads. They would also be able to calculate the diameters of solid and hollow shafts which are subjected to combined bending and twisting moments. Couplings with their different types and corresponding design would also be studied in Machine Design. Design of ropes and belts which are used mainly for the transmission of power from one source to another would be carried out. Different welded and riveted joints would also be considered from the design point of view when subjected to different static loading. Springs and gears along with their design and different types suitable for different conditions and purposes are also included in this course which students will analyze. A main industrial equipment bearing with its brief introduction, types and different application would also be emphasized Modelling including wireframe, solid and surface is also included from design point of view.

Contents

1. Introduction to design.
2. Design consideration.
3. Basic concepts in designing.
4. Design of solid and hollow shafts subjected to combined twisting and bending moment.
5. Flange couplings and proportional sizes.
6. Calculation of stresses due to static loading.
7. Design of belts and ropes for given power transmission.
8. Design of helical spring, conical and volute springs, torsion spring, leaf spring spiral springs.
9. Gear terminology and design of spur gear.
10. Selection of ball and roller bearings.

Recommended Texts

1. I.E. Shigley. (2011). *Mechanical engineering design*. USA: Prentice-Hall, Inc.
2. R.C. luvinall & K.M. Marsak. (2011). *Fundamentals of machine component design*. UK: McGraw Hill.

Suggested Readings

1. Jindal U. C. (2010). *Machine design*. UK: McGraw Hill.
2. P. C. GOPE. (2012). *Machine design*. USA: Prentice-Hall, Inc.

MT-411 **Industrial and Environmental Safety** **2 (2+0)**

Enable the students to know and apply safety standards rules in industry which are involved in preventing accidents. Classification of Health hazards which includes Physical, chemical and biological would be done. Sources of risk including Machinery Noise, Electrical failure, ventilation, lighting, radiation would be elaborated. Information about Dangerous substances like Classification, Entry and Exit routes, safe handling, Health & safety, regulation and policy will be told. Equipment & Machine handling like Mechanical & Manual Handling, Access equipment, Transport, Electricity & Electrical Equipment will be discussed. Fire related. information Classification, fire protection, means of Escape, Actions to be taken will be given. Safety Management will be discussed. which includes Accident prevention, health & safety training, communicating safety measures will be told. So, this subject has a very broader perspective about the safety while working in an industry and is very crucial and integral part of any industry, and working of industry is directly connected. towards it.

Contents

1. Classification of Health hazards: Physical, chemical, biological.
2. Sources of risk: Machinery Noise, Electrical failure, ventilation, lighting, radiation.
3. Dangerous substances: Classification, Entry and Exit routes, safe handling, Health & safety, regulation and policy.
4. Safety Machining and Guarding: Preventing Machining accidents, Machine guarding.
5. Equipment & Machine handling: Mechanical & Manual Handling, Access equipment, Transport, Electricity & Electrical Equipment.
6. Fire: Classification, fire protection, means of Escape, Actions to be taken.
7. Chemical safety.
8. Personal protection.
9. Safety Management: Accident prevention, health & safety training, communicating safety measures.

Recommended Texts

1. Murphy H. A., Hildebrandt H. W. and Thomas J.P. (2001). *Effective Business Communications*. USA: McGraw-Hill.

Suggested Readings

1. T Norman S. (2010). *We're in Business*. UK: Longman Group Ltd.
2. Thomson A. J. and Martinet A. V. *A (1993). Practical English Grammar*. Oxford: Oxford University Press

MT-223 **Manufacturing Processes** **4 (2+2)**

Manufacturing engineering or manufacturing process are the steps through which raw materials are transformed. into a final product. The manufacturing process begins with the product design, and materials specification from which the product is made. These materials are then modified through manufacturing processes to become the required. part. Manufacturing process is that part of the production process which is directly concerned. with the change of form or dimensions of the part being produced. It does not include the transportation, handling or storage of parts, as they are not directly concerned. with the changes into the form or dimensions of the part produced. Operations like Lapping, Honing, Super finishing, Polishing, Buffing, Electroplating, Galvanizing, Metal Spraying would be discussed. Single point tool Geometry and Multi point tools would be studied. Press machines, types of Press machines and Press work operations would be observed. Ultrasonic machining would also be discussed in this course.

Contents

1. Mechanics of chips formation, Types of chips produced.
2. Chip breakers, Orthogonal & Oblique cutting, Cutting forces in conventional turning,
3. Friction & heat sources in cutting
4. Surface finishing processes.
5. Lapping, Honing, Super finishing, Polishing, Buffing, Electroplating, Galvanizing, Metal Spraying
6. Single point tool Geometry, Multi point tools
7. Tool life & wear, Tool failure, Factors affecting tool life, Measuring tool life
8. Tool material & its characteristics
9. Cutting fluids, Purposes, Types & properties of cutting fluids
10. Broaching & broaching machines,
11. Press machines, types of Press machines and Press work operations
12. Sheet metal characteristics, Formability of sheet metals
13. Bending sheet & plate, Tube bending & forming
14. Deep drawing, Super plastic forming
15. General Design principle and Elements of Jig
16. Locating Devices & Clamping Devices
17. Ultrasonic machining and Abrasive jet machining and Water-jet machining
18. Electrical discharge machining (ED.M) and Electromechanical machining & grinding
19. Laser beam machining, Electron beam machining and Chemical milling, Blanking and Engraving

Recommended Texts

1. SK Hajra Choudry, (2016). *Elements of Workshop Technology*. UK: Longman Group Ltd.
2. Stanley A. K, Ann E. Lawson & Andrew C. H, (2018). *Manufacturing Technology*. USA: McGraw-Hill.

Suggested Readings

1. BH Amstead & PF Ostwald, (2015). Manufacturing Processes. USA: McGraw-Hill.
2. Degarmo Black & Kohscr Amstead,(2012) *Materials and Processes in Manufacturing.* Oxford: Oxford University Press.

MT-224 **Fluid Mechanics** **4 (3+1)**

The main aim of this course is to provide a platform for students to understand the different properties of fluids in statics and kinematics and also will be familiar with flow and pressure measuring instruments. Upon successful completion of the course, the student will be able to apply the basic concepts to hydrostatic fluid problems. Analyze the fluid kinematics and dynamics parameters using basic laws of mechanics. Solve the pipe flow problems using Bernoulli and energy equation. Introduction of this subject would include development of fluid dynamics, distinction between solid and fluid, gas and liquid, properties of fluids, Density, specific weight, specific volume, specific gravity, compressible and incompressible fluids, ideal fluids, viscosity and its units, surface tensions, vapor pressure of liquids etc. Fluid Statics, Kinematics of Fluid Flow, Measurement of flow rate velocity and Similitude and Dimensional analysis would be studied. All these topics would be studied in detail to gain an in depth knowledge.

Contents

1. Introduction: Development of fluid dynamics, distinction between solid and fluid, gas and liquid,
2. properties of fluids, Density, specific weight, specific volume, specific gravity, compressible and incompressible fluids, ideal fluids, viscosity and its units, surface tensions, vapor pressure of liquids etc.
3. Fluid Statics: Pressure, variation of pressure in a static fluid, pressure head, review of types of
4. pressures, pressure measurement gauges, Force on plane area, center of pressure, force on curved. surface, Buoyancy and stability of submerged and floating bodies.
5. Kinematics of Fluid Flow: Types of flow, flow rate and mean velocity, equation of continuity,
6. flow net, velocity and acceleration in steady and unsteady flow.
7. Measurement of flow rate velocity: Energy Consideration in Steady Flow: Kinetic energy of a
8. flowing fluid, potential energy, internal energy, general equation for steady flow of any fluid, energy equation for steady flow of incompressible fluids. Bernoulli's theorem, Head, Power consideration in fluid flow cavitation's, energy equation for steady flow of compressed fluids, equation of steady motion along a steam line for ideal fluid and Euler's equation, equation of steady motion along a streamline for real fluid, Hydraulic gradient, energy line, problems, Pressure in fluid flow and its measurement, set trajectory, flow in a curved. path, vortex, types of vortex.
9. Similitude and Dimensional analysis: Definition and importance, geometrical, kinematic and
10. dynamic similarity, dimensionless ratios, scale ratios, dimensional analysis. Steady & Incompressible Flow in Pressure conduits: Laminar and Turbulent flow, critical Reynold's number, hydraulic radius, general equation for friction, Darcy-Weisbach pipe friction equation, laminar flow in circular pipes, turbulent flow in circular pipes, pipe roughness, chart for friction factor, fluid friction in non-circular conduits, empirical equations for pipe flow. Flow measurements, Pitot tubes, venturi meter, orifices, nozzles.

Recommended Texts

1. Daugherty and Franzini. (2005). *Fluid mechanics with engg*. application. USA: McGraw Hill.
2. Victor L. Strecter. (2010). *Fluid mechanics*. USA: McGraw Hill.

Suggested Readings

1. K R Arora, (1997). *Fluid mechanics and hydraulic machinery*. India: Standard Publisher India.

MS- 225 Total Quality Management 2 (2+0)

The main aim of this course is the study of quality and the concept of total quality management in organizations. Total quality is a description of the culture, attitude and organization of a company that strives to provide customers with products and services that satisfy their needs. The culture requires quality in all aspects of the company's operations, with processes being done right the first time and defects and waste eradicated from operations. Total quality management is a method by which management and employees can become involved in the continuous improvement of the production of goods and services. It is a combination of quality and management tools aimed at increasing business and reducing losses due to wasteful practices. Some of the companies who have implemented TQM include Toyota, Ford Motor Company, Phillips Semiconductor, SGL Carbon, Motorola and Toyota Motor Company. The course aims at familiarizing the students with quality and its basic concepts, TQM principles, tools and techniques for quality improvements and quality management and environmental management systems.

Contents

1. Quality
2. Commitment and Leadership
3. Charting/Planning Design for quality
4. Quality related costs
5. Quality measurements
6. Implementing TQM
7. Quality Management System (ISO 9000 series)
8. Environmental Management System (ISO 14000 series

Recommended Texts

1. Besterfield, D.H. (2016). *Total Quality Management*. New Delhi: Pearson education.
2. Oackland, J.S. (2019). *Total Quality Management and operational excellence (5th ed.)*. London: Elsevier.

Suggested Readings

1. Sharma, S. C. (2017). *Industrial engineering and management*. New Delhi: Khanna Publication.
2. Morse, L.C. Babcock, D.L. (2019). *Managing Engineering and Technology* (7*th* ed.). London: Pearson.

MT-311 **I.C Engines** **3 (2+1)**

After studying this course students would be able to have a sound knowledge about different internal combustion engines. Their working along with their different types would be analyzed. by students. Different strokes though which the internal combustion engines go through and power delivered. by these strokes would be analyzed. The purpose of this course would also be to let the students understand systems of various internal combustion engines and also the different components or parts. Services and overhauling of these I.C Engines would also be discussed. in detail. Basic purpose of this course is to make students to have a well awareness of the internal combustion engines basics, construction and along with their working as they a Vitol part of mechanical engineering. Components like carburetor, spark ignitor, along with working cycles and different air fuel mixing ratios are being considered. in this course. Engines cooling and lubrication including different coolants and lubricants are also being discussed.

Contents

1. History and development of I.C. Engines
2. Spark ignition Engines, Compression ignition Engines, Fundamental difference between SI and CI Engines
3. Four stroke petrol engine, Two Stroke petrol engine, Four Stroke Diesel engine, Two stroke Diesel engine, Comparison of petrol and diesel engines, Comparison of 4-stroke and 2~stroke engines
4. SI engines and CI engines
5. Construction of simple carburetor, Types of carburetors
6. Full range of load, Full range of speed
7. Air injection system, Solid injection system and Their merits and demerits
8. Full Range of load, Full range of speed
9. Battery ignition system, Magneto ignition system, Electronic ignition system
10. Their effect on the output of reciprocating engines
11. Necessity of cooling, Types of cooling system, Necessity of Lubrication, Types of lubrication system
12. Installed in road vehicles, Installed in industry
13. Vehicle engine, Industrial engines

Recommended Texts

1. C.I Tayler. (1985). *I.C. engines*. USA: McGraw Hill.
2. J.B Heywood. (2000). *I.C. Engines fundamentals.* USA: McGraw Hill.

Suggested Readings

1. Richard stone. (1997). *Introduction to I.C. engines.* New Delhi: Khanna Publication.
2. Dr. R.K signal (2005). *Internal combustion engine.* New Delhi: Khanna Publication.

MT-312 **Plant Maintenance** **2 (2+0)**

After studying this course students would be able to have a sound knowledge of different types of maintenance processes that took place in the industries. Factors like cost control, maintenance and specially maintenance nowadays by the computer system would be under consideration. First portion in plant maintenance as included in this course involves equipment installation, means a complete process of the installation of the equipment's in an industry. Second portion includes the organization and the management of the maintenance function which includes the maintenance cost and operating policies. Third which is similar to the second as discussed. above is establishing the cost and controls of maintenance and a most important factor nowadays which is the use of computer technology in the plant maintenance nowadays. Computer maintenance is known as automated maintenance. Controlling and scheduling is being done by the computer in this new technology. Students would be able to judge that how labor force have been reduced to a great extent by the computer role in plant maintenance.

Contents

1. Selection of Appropriate Location for Installation. Design and Preparation of Foundation for Equipment. Provision of Supplies and Services
2. Transportation, Unpacking and checking the equipment as per specifications Checklist of Precautions to be observed.
3. Introduction to the Theory and practice of maintenance
4. Operating policies Operating practices to reduce maintenance control
5. Reports from maintenance dep't. Area and Centralized Maintenance control
6. Considerations in using outside contractors
7. Incentive payment for maintenance workers
8. Work measurement. Work authorization and control
9. Rating and evaluating maintenance: Work simplification in maintenance
10. Estimating repair and maintenance costs and small plant maintenance control
11. Maintenance Control and inventory control: An introduction to computers in maintenance
12. Automating maintenance information by computer
13. Computerized. planning and scheduling Computer terminology defined.

Recommended Texts

1. Higgins L.R. (2002). *Maintenance engineering handbook*. UK: McGraw Hill Book Company.

2. Weaver R, (2002). *Manger's guide to machinery maintenance*. UK: Prentice Hall.

Suggested Readings

1. Pertocelly K and Press F. (2000). *Commercial and institutional maintenance management*. UK: McGraw Hill Book Company.
2. Lamb R. G. ((1995) *Availability engineering and management for manufacturing plant performance*. UK: McGraw Hill Book Company.

MT-313 **Mechanical Vibrations** **4 (3+1)**

After studying this course students would be able to have a knowledge about the basic concepts and terminologies which are being used in the mechanical vibrations. Vibrations in different mechanical systems would be considered and main emphasize would be on the methodology to remove these vibrations from the mechanical systems. Revision of matrix algebra would be applied. Harmonically excited. vibration would be studied in this course. Different mechanical systems including gravity pendulum, spring mass vibration system, stiffness, potential energy, stability, torsional pendulum, free vibration and resonance would be studied. Physical stiffness of elements including Rods, beams, stiffness coefficients as matrix elements would be under observation for mechanical vibrations. Eigen value analysis which involves two degree of freedom problems, three degree of freedom problems, determination of modes of vibration would be applied. At the end Rayleigh's method and its applications would be used for the determination of the mechanical vibrations in different mechanical systems.

Contents

1. Introduction, types of vibration, basic concepts and terminologies
2. Characteristic equations, solution methods
3. Free vibration
4. Equation of motion., energy methods
5. Series and parallel combination
6. Viscously damped free vibration, logarithmic decrement
7. Coulomb damping, forced harmonic vibration
8. Rotating unbalanced.
9. Vibration measuring instruments, gravity pendulum
10. Spring-mass vibrating system
11. Compound gravity pendulum
12. Stiffness, potential energy, stability, torsional pendulum 13 Free vibration and resonance
13. Rods, beams
14. Stiffness coefficients as matrix elements
15. Two degree of freedom problems, three degree of freedom problems, determination of modes of vibration
16. Rayleigh's method and its applications

Recommended Texts

1. William, T. and Thomson. (2014). *Vibration theory and applications.* UK: McGraw Hill Book Company.
2. Kelly. (2009). *Fundamentals of mechanical vibrations*. UK: Prentice Hall.

Suggested Readings

1. S S Rao. (2004). *Mechanical vibration.* UK: Prentice Hall.
2. Ivana Kovacic, Dragi Radomirovic. (2014). *Mechanical vibration.* UK: Prentice Hall.

MT-314 **Instrumentation and Control** **3 (2+1)**

After studying this course students would be able to have a knowledge about the basics of control system and measurement instrumentations being used. Basic control system including both open and closed loop control system with the feed Back control system would be discussed. Elements of general control system would be explained and the transfer function for different control system would be obtained. Also study of different instruments used for the measurement of length, force, torque, frequency, pressure, flow and temperature will be carried out. Free body Diagram and Newton's law of motion would be utilized for the calculation of various physical quantities. Equations of motion for a spring mass and damper system is also focused. The concept of stability and Routh criterion & root locus method for stability measurements in the control system is carried out in this course. So, instrumentation and control are all about control of the systems used in different industries and measurement of different physical quantities.

Contents

1. Introduction to control system.
2. Open loop and closed loop control system.
3. Feedback control system.
4. Elements of a general control system and their examples.
5. Transfer function.
6. Transducers and classification of Transducers.
7. Measuring and recording instruments for length, force, torque, frequency, pressure, flow and temperature.
8. Free body Diagram and Newton's law of motion.
9. Operational notation.
10. Equation of motion for a spring mass and damper system.
11. Electrical & Mechanical analogous circuits.
12. Stability concept, Routh criterion and root locus method for stability measurements.

Recommended Texts

1. Francis H Raven (1995) *Automatic control* .USA: John Wiley & Sons, Inc.
2. Richard C dorf, (2011) *Modern control system.* UK: McGraw Hill.

Suggested Readings

1. J.J Distofanoelef,(2013) *Automatic control.* UK: McGraw Hill.
2. Katsuhiko Ogata, (2010) *Modern Control Engineering.* USA: John Wiley & Sons, Inc.

MT-321 **Production Automation** **3 (2+1)**

After studying this course students would be able to have a sound knowledge of basic automation and also about the economics of automation. Different mathematical models would be considered. Different types of technologies that how computer system is used in industrial work for various purposes would be analyzed. Latest technologies like group technologies and flexible manufacturing would be discussed. Use of computers as CNC for machining process and in the form of technologies like CAD and CAM would be discussed. Terminology programmable logic control will be explained and the student will be able to analyze the role of computer in machining, design and production of various products in industry. CNC machines with their automated functions like Control panel description, tool function, practical application of tool wear offset, feed function, spindle function, programming of CNC in absolute and incremental system will be studied. So basically, fully role of computer for automation purposes will be seen.

Contents

1. Automation introduction and economics of automation.
2. Flow lines and mathematical models.
3. Group Technology and Flexible manufacturing.
4. Robotics Geometry.
5. Uses of CNC machines.
6. Advantages and machine Control of CNC machines
7. CNC machines general information.
8. Tool function and practical application of tool wear offset.
9. Programming of CNC in absolute and incremental system.
10. CAD/CAM approach to part programming.
11. CAD/CAM application (turning problem, surface milling, machining of curved surfaces.) Programmable Logic Controllers.
12. Advantages of PLCs.
13. Ladder Logic Diagrams.
14. Switching Logics.
15. Components of PLC.
16. PLC Operating Cycle.
17. PLC operation and applications.

Recommended Texts

1. MR Groover, (2000) *Automation, Production System, & CAM*. USA: John Wiley & Sons, Inc.

2. C.R. Asfahl,(2010). *Robotics & Manufacturing Automation*. USA: John Wiley & Sons, Inc.

Suggested Readings

1. Bollinger & Duffie, (2009). *Computer Control of machines & Processes.*UK: McGraw Hill.

2. G.Salvendy, (1992) .*Handbook of Industrial Engineering*. UK: McGraw Hill.

MT-315 **Material Handling** **2 (2+0)**

Material handling involves short-distance movement within the confines of a building or between a building and a transportation vehicle.[1] It uses a wide range of manual, semi- automated., and automated. equipment and includes consideration of the protection, storage, and control of materials throughout their manufacturing, warehousing, distribution, consumption, and disposal. Material handling can be used to create time and place utility through the handling, storage, and control of waste, as distinct from manufacturing, which creates form utility by changing the shape, form, and makeup of material. Introduction to Material Handling Equipment, Marketing would be studied. Conveyers different types including Vibratory Conveyers, Feeders and Screws would be studied. Package and Unit Conveyer Systems, Belt Package Conveyer Power Roller conveyer would also be studied. Some advanced studies including Automated. Guided Vehicles and their Applications and Use of Robots would be done. Pallet Transporters and Material Handling Tools would also be observed in this course.

Contents

1. Introduction, Material Handling Equipment, Marketing
2. Principles of material handling, factors affecting material handling
3. Belt Conveyers, Bucket Elevators and Bucket Conveyers, Screw
4. Conveyers, Vibratory Conveyers, Feed.ers and Screws
5. Vehicle Bulk Handling Systems, Marine Bulk-Material Handling
6. Pallets and Palletizing Operations
7. Package and Unit Conveyer Systems, Belt Package Conveyer Power Roller conveyer
8. Conveyer Turns and Switches, Conveyer Sortation and Accumulation Systems, Pallet Conveyers
9. Light Duty Chain and Cable System, Heavy Duty Systems
10. Power-and Free Systems
11. Powered-Carrier Monorail Systems
12. Reach-Type Non-Aisle Forklift Trucks
13. Narrow-Aisle Turret-Type Forklift Trucks
14. Side-Loading Forklift Trucks,
15. Vehicular Unit Handling equipment,
16. Pallet Transporters and Material Handling Tools. Towline Systems
17. Tractor-Trailer Trains.
20. Automated Guided. Vehicles and their Applications, Use of Robots

Recommended Texts

1. Sims Jr. E.R, (2008) "Planning and Managing Industrial Logistics Systems". USA: John Wiley & Sons, Inc.
2. Raymond A. Kulwiec, (1985). Material Handling Handbook (2nd ed.). USA: John Wiley & Sons, Inc.

Suggested Readings

1. Maynard's, (2005). Industrial Engineering Handbook. UK: McGraw Hill.
2. Langford J. W, (2010). Logistics Principles and Applications. UK: McGraw Hill.

MT- 322 Renewable Energy and Environmental Technology 4 (3+1)

The main aim of this course is the study of renewable energy resources and effect of environmental pollution on society. Renewable energy is energy that is collected. from renewable resources, which are naturally replenished on a human timescale, such as sunlight, wind, rain, tides, waves, and geothermal heat. Solar and wind energy projects are already working in Pakistan. Different kinds of pollution are also harmful for our environment especially industrial pollution. The primary purpose of this course is to provide students with a broad understanding of energy resources, power plants, jet propulsion plants and different kind of pollutions. The course has been divided. into three parts, energy resources, conventional and non-conventional power plants and pollution. Specific objectives of this subject are to enable the students to comprehend energy resources, alternative energy resources, power plants, environmental pollution and its remedies. Pre-requisite for this course is thermodynamics and the renewable energy technology.

Contents

1. Energy Resources
2. Alternative Energy Resources
3. Modern Steam Power Plants
4. Gas Turbine Power Plants
5. Combine Cycle Power Plants
6. Jet Propulsion Plant
7. Nuclear Power Plants
8. Environmental Pollution
9. Atmospheric Pollution
10. Industrial Waste
11. Water Pollution
12. Noise Pollution

Recommended Texts

1. Wakil, M. El. (2013). *Power plant technology*. New York: McGraw-Hill.
2. Cengel, Yunus A. Boles, M.A. (2019). *Thermodynamics: an engineering approach* (9th ed.). New York: McGraw-Hill.

Suggested Readings

1. Nag, P. K. (2014). *Power plants engineering.* New Delhi: Tata McGraw-Hill.
2. Pierce, J.J. Vesilind, P.A.Weiner, R. (1997). *Environmental pollution and control*. London: Elsevier.

MT-323 **Metrology & Gauging** **3 (2+1)**

This course is an introduction to the fundamentals of dimensional measurement, production gages, and gaging techniques. Interpretation of geometric tolerances will also be covered., with respect for their implications for inspection. Measurement techniques will emphasize proper use of and setup of equipment including gage blocks, sine bars and sine plates, surface plates, analog and digital measuring devices, precision levels, optical comparator, measuring microscope, protractors and coordinate measuring machines. It also provides a basic understanding of various metrology terms and concepts. At the end student will be able to identify the uncertainties in dimensional metrology, define measurement standards, describe the fundamentals of dimensional and geometrical tolerances, measure length and angles using line graduated instruments i.e. Vernier calipers, micrometers, bevel protractor, sine bar and surface plates. Student will also able to use comparative length-measuring instruments, i.e. dial indicators, to measure variations in the distance between two or more surfaces, use gage blocks to measure various workpieces

Contents

1. Standards and Measurement: Krypton 86 as Measurement Standard, Methods of Interferometry, Principle and Use of Optical Flat, Laser Beam as Measurement Standard
2. System of Limits and Fits: Basic Terminology, Unilateral and Bilateral Tolerance Systems, Geometrical Tolerances. Standard Tolerances, Classes of Standard Fits, Hole Based and Shaft Based Systems, Grades of Fits.
3. Linear Measurement: Line and End Standards, Use of Slip Gauges, Dial Indicators and Surface Plates, Vernier Calipers, Micrometers and Height Gauges, Laser Based Equipment, Comparators.
4. Angular Measurements: Protractors, Sine Bars, Angle Gauges, Levels, Clinometers, Autocollimators, Taper Gauges, Surface Texture.
5. Introduction and Units: Measurement with Light Wave interference, Mechanical Methods of Measurement, Waviness and Lay, Roughness, Value and Cutoff, Surface Texture Symbols, Preferred Roughness, Average Values.
6. Gauges and Gauging: Introduction to Fixed Limit Gauges, Basic Terminology, Types, Gauge, Tolerance, Gauging Systems, Screw Thread and Pipe Thread Gauges, Mechanical Amplification Gauge Systems, Pneumatic Gauges, Electric and Electronic Gauges.
7. Coordinate Measuring Machines: Introduction, Working Principles, Types, Applications, Advantages, Economic Consideration.

Recommended Texts

1. Hume K.J. (1995). *Engineering metrology*. London: Macdonald and Company.
2. Galyer J and Shotbolt C. (1990). *Metrology for engineer*. London: Cassell Ltd.

Suggested Readings

1. Morris A. (1991) *measurement and calibration for quality assurance*. UK: Prentice Hall.
2. N.V. Raghavendra and L. Krishnamurthy. (2013). *Engineering metrology and measurements*. Oxford: Oxford university press.

MT-324 **Refrigeration and Air Conditioning** **4 (3+1)**

The course studies the fundamental governing laws of refrigeration and air conditioning. The following topics are covered vapor compression system, vapor absorption system, heat pumps, air conditioning, psychrometric chart. After this, the students will be able to calculate heating load and cooling loads room/buildings. Refrigeration and Heat pump Cycles would be studied. Properties of refrigerants and brine would be discussed. Carnot and Joule reverse cycles, Vapor-compression and vapor absorption cycles, Coefficient of performance, Efficiencies would be studied. Refrigeration Machines: Cold air, vapor-compression, Steam-jet and absorption types Heat pumps, Domestic type, Auxiliaries, and controls would be observed. Application of Refrigeration: Cold storage, Ice-making, Dairying, Quick freezing air conditioning, Layouts, Load calculation and performance would be completed. Air conditioning and Ventilation: Use of the psychrometric charts would be seen. Air conditioning equipment window type, split type, package type, cooling towers, air washers, chillers, duct layout would be designed. So, after the study of this course we would have a sound knowledge of refrigeration and air conditioning.

Contents

1. Refrigeration and Heat pump Cycles.
2. Properties of refrigerants and brine.
3. Carnot and Joule reverse cycles, Vapor-compression and vapor absorption cycles, Coefficient of performance, Efficiencies.
4. Refrigeration Machines: Cold air, vapor-compression, Steam-jet and absorption types Heat pumps, Domestic type, Auxiliaries and controls.
5. Application of Refrigeration: Cold storage, Ice-making, Dairying, Quick freezing air-conditioning, Layouts, Load calculation and performance.
6. Air conditioning and Ventilation: Use of the psychrometric charts.
7. Calculation of heat to be removed by an air-conditioning plant.
8. Air-conditioning requirements for comfort and industrial processes.
9. Air conditioning equipment: window type, split type, package type, cooling towers, air washers, chillers, duct layout.

Recommended Texts

1. Jordan (1956). *Refrigeration and air conditioning* (2nd ed.). New York: NJ: Prentice Hall. Inc.
2. Stocker W.F (1983). *Refrigeration and air conditioning* (2nd ed.). New York: McGraw Hill ed.ucation.

Suggested Readings

1. Dosset R.J. (2002). *Principles of refrigeration* (4th ed.). UK: Pearson.
2. Arora C.P. (2000). *Refrigeration and air conditioning* (2nd ed.). New York: McGraw Hill education.

PK.ST-325 **Pakistan Studies** **2 (2+0)**

Develop vision of historical perspective, government, politics, contemporary Pakistan, ideological background of Pakistan. Study the process of governance, national development, issues arising in the modern age and posing challenges to Pakistan. Historical Perspective which include Ideological rationale with special reference to Sir Syed Ahmed Khan would be studied. A llama Muhammad Iqbal and Quaid-i-Azam Muhammad Ali Jinnah personalities would be studied. Factors leading to Muslim separatism and People and Land: Indus Civilization would be covered. Location and geo-physical features and Government and Politics in Pakistan Political and constitutional phases would be studied. Contemporary Pakistan: Economic institutions and issues would be seen. Society and social structure of Pakistan would be analyzed. Foreign policy of Pakistan and challenges would be seen, Foreign policy of Pakistan and challenges faced by Pakistan would be seen. In short, a sound knowledge about the historical perspective of Pakistan would be gained by the students after studying this course.

Contents

1. Historical Perspective: Ideological rationale with special reference to Sir Syed Ahmed Khan
2. A llama Muhammad Iqbal and Quaid-i-Azam Muhammad Ali Jinnah
3. Factors leading to Muslim separatism
4. People and Land: Indus Civilization
5. Muslim advent
6. Location and geo-physical features.
7. Government and Politics in Pakistan Political and constitutional phases:
8. 1947-58
9. 1958-71
10. 1971-77
11. 1977-88
12. 1988-99
13. 1999 onward
14. Contemporary Pakistan: Economic institutions and issues.
15. Society and social structure.
16. Ethnicity.
17. Foreign policy of Pakistan and challenges and Futuristic outlook of Pakistan

Recommended Texts

1. Shahid Javed. (1980). *State & society in Pakistan*. Karachi: Sang-e-meel publications.
2. Zaidi. S. (2000) Issue in Pakistan’s economy. Karachi: Sang-e-meel publications.

Suggested Readings

1. Burke S.M. (1993) Pakistan‟s foreign policy: an historical analysis. Karachi: PLD publications.
2. Ziring(1980). Enigma of political development. Kent England: PLD publications.
3. Ansar (1980). History & culture of Sindh. Karachi: PLD publications.

MT-325 **Project Management** **2 (2+0)**

Enable the students to develop Managerial skills, get acquainted with the principles of management & human relations. Skills and traits like Industrial Management, Organization, Foremanship and leadership would be taught to the students. Knowledge about Production like Introduction, method of production, advantages & disadvantages, planning & scheduling, introduction to CPM and PERT will be given. Inspection process which includes Definition, objectives, function of inspection dept., qualities of inspector, major principles, standard of inspection, kind of inspection, advantages and disadvantages would be described. Human Resource Management which includes Management styles, psychological types, recruitment and training, job evaluation, performance appraisal, motivation and incentives would be explained. Inventory control would be discussed. which includes: Introduction, types of inventory, need of inventory control, the maximum stores, minimum stores, the standard order, the ordering point, lead & procurement time, Economic ordering quantity (EOQ), Use of computer.

Contents

1. Industrial Management: Introduction, Management as science or art, history of management, management functions.
2. Organization: Introduction, organizational structure, types, their advantages & disadvantages.
3. Foremanship & leadership: Introduction, duties of foreman, essential qualifications of a foreman, types of leaders, acceptance of administration, leadership, qualities of leadership.
4. Inventory control: Introduction, types of inventory, need of inventory control, the maximum stores, minimum stores, the standard order, the ordering point, lead & procurement time, Economic ordering quantity (EOQ), Use of computer.
5. Production: Introduction, method of production, advantages & disadvantages, planning & scheduling, introduction to CPM & PERT.
6. Inspection: Definition, objectives, function of inspection dept., qualities of inspector, major principles, standard of inspection, kind of inspection, advantages & disadvantages.
7. Human Resource Management: Management styles, psychological types, recruitment and training, job evaluation, performance appraisal, motivation and incentives.

Recommended Texts

1. Babcock D.L. (2002). *Managing engineering & tech*. New York: McGraw Hill Education.

Suggested Readings

1. Banga & Sharma. (2001). *Industrial management.* New York: McGraw Hill Education.

MT-421 **Supervised Industrial Training** **36 (0+36)**

Students will undergo industrial training which would be properly supervised. Progress will be recorded on the monthly basis and would be submitted to the institute by their supervisor. The institute would also contact with all industrial supervisors to check the student's performance. At the end of the training, the students are required. to submit a detailed. report to the institute and undergo viva-voce examinations so the proper assessment of the students for their industrial work can be done.

Guidelines

1. The students shall undergo Supervised Industrial Training (minimum duration of 36 Credit Hours)
2. The students are required to submit monthly Progress Report to the institute duly verified by their Industrial supervisor.
3. The institute is responsible to contact with all industrial supervisors to check the student's performance.
4. At the end of the training, the students are required to submit a detailed report to the institute and undergo viva-voce examinations.

BS
ELECTRICAL ENGINEERING TECHNOLOGY

MATH-111 Applied. Mathematics-I 3 (3+0)

This course has been designed. to review the knowled.ge and practice the skills acquired. in diploma Courses, to understand the concept and use of differential equations, to learn different methods to solve differential equations. Basic calculus in which matrices and determinants would be involved will be practiced. Introduction to Differential Equations Basic Concepts in which linear first order differential equation and, Bernoulli's Differential Equations and the equations related. to them would be discussed. Higher Order Differential Equations means second order differential equations will be involved. Partial differential equations will also be practiced. At the end complex numbers would be studied and operations related to them would be solved. In this way students' analytical skills will be improved to a great extent. After solving these complex problems students would have a firm grip on problem solving which plays a very important role from design point of view in engineering field.

Contents

1. Real numbers and real line
2. Differential Calculus: The derivatives as a function, Differential Rules
3. The derivative as a rate of change, Derivatives of algebraic functions
4. Derivatives of exponential functions, Derivatives of trigonometric functions
5. The chain rule and parametric equations, Implicit differentiation
6. Inverse functions and their derivatives, Derivatives of inverse trigonometric functions
7. Derivatives of hyperbolic functions, Findings of horizontal and normal tangents
8. Extreme values of functions, the mean value theorem.
9. Integral Calculus: Basic integration formulas
10. Integration by parts, Indefinite integrals and the substitution rule
11. Integration of rational functions by partial fractions, Improper integrals
12. The definite integral, Substitution and area between curves
13. Volume by slicing and rotation about an axis, Volume by cylindrical shells
14. Area of surface of revolution.
15. Complex numbers, addition, multiplication, subtraction and division

Recommended Texts

1. Thomas G. B. and Finney R. L. (2001). *Calculus and analytic geometry* (13th ed.). Boston: Addison-Wesley.
2. Kreyszig E. (2011). *Advanced engineering mathematics* (10th ed.). USA: John Wiley and Sons.

Suggested Readings

1. Cohen H. L. (2006). *Mathematics for scientists and engineers*. UK: Prentice-Hall.

CS-112 **Computer Applications** **1 (1+1)**

This course serves as an introduction to computer terminology, computer equipment, and provides fundamental concepts for using PC-based. software. This course is designed. to ensure that students are current and informed. in order to thriven our technology-oriented., global society. The students not only learn about relevant cutting-ed.ge technology trends, but they also gain a better understanding of technology in general. This introductory course explains in straightforward terms the importance of learning about computers and other computing devices, the various types of devices and their components, the principles by which computers work, the practical applications of computers and related. technologies, the ways in which the world is being changed. by these technologies, and the associated. risks and other potential implications of computers and related. technologies. The goal of this course is to provide students with a solid knowled.ge of computing fundamentals, an understanding of the impact of our technology-oriented. society, and a framework for using this knowled.ge effectively in their lives.

Contents

1. Introduction to computer: digital and analog computers, characteristics of computer, history of computer, generations of computer
2. Classification of computer, the computer system, the input-process-output concept, components of computer hardware, application of computers
3. The computer system hardware: central processing unit (CPU), memory unit
4. Instruction set, instruction cycle, microprocessor, interconnecting the units of a computer, performance of a computer, inside a computer cabinet
5. Computer memory: memory representation & hierarchy, registers, cache primary memory
6. Secondary memory, access types of storage devices, magnetic tape, magnetic and optical disk
7. I/O devices: input-output unit, input devices, human data entry and source data entry devices
8. Output devices, hard copy devices, soft copy devices, i/o port, working of i/o system
9. Data representation: number system, conversion from decimal to binary, octal, hexadecimal
10. Conversion of binary, octal, hexadecimal to decimal, conversion of binary to octal, hexadecimal, conversion of octal, hexadecimal to binary
11. Binary arithmetic, signed. and unsigned. numbers, binary data representation
12. Binary coding schemes, logic gates
13. Interaction of user & computer: system software and its types, operating system, device drivers
14. Programming language, translator software, linker, and loader software, application software
15. Data communication and computer network: importance of networking, data transmission
16. Data transmission and data networking, computer network, wireless networking

Recommended Texts

1 Morley D, Parker, C. S. (2014). *Understanding computers: Today and tomorrow, comprehensive* (14th ed.). Australia: Cengage Learning.

Suggested Readings

1 Tucker, Bradley, W. J, Cupper, R. D, & Garnick, D. K. (1992). *Fundamentals of Computing* (2nd ed.). London: McGraw-Hill.

2 Goel A. (2010). *Computer fundamentals* (1st ed.). India: Pearson Education.

CS-112 **Computer Applications (Lab)** **1 (0+1)**

This course, using laboratory practice, introduces students to basic computer concepts in hardware, software, networking, computer security, and other emerging technologies such as blogs, wiki and Google applications. Widely used. applications including word processing, spreadsheets, presentation, and MATLAB tools are studied. The purpose of the information technology requirement is to ensure that students achieve an essential understanding of information technology infrastructure encompassing systems and devices; learn to make the most of the widely used. packages and other network resources; take advantage of latest technologies; and become more sophisticated. technology users.

Contents

1. To Study Basic Computer Organization, Elements of Computer Systems Hardware & Software, Block Diagram of Computer, CPU Memory, I/O devices, Setting Up to PC.
2. Introduction to Word Processing, Package Installation, MS Word 2013, Creating a new word document, Opening, Editing, etc.
3. Formatting Page, margins, page size, portrait, using bullets, Using and manipulating tables, inserting deleting of rows and columns in Word Processing Application.
4. Sorting Tables, Using header, footer, inserting page #, printing a document, Shortcuts of various activities in Word, Charts Creating, Drawing of Charts, and Modifying Charts.
5. Intro to Spreadsheet Application, Launching and Exploring Excel, entering data into Spreadsheet, Widen rows & Columns in Excel, Centering Data in a Cell, Font Formatting.
6. Entering data into Cells, Basic Operators, adding up with sum, Multiplying and Avg. function in Spreadsheet application.
7. Conditional formatting, The Count IF, & SUMIF function, Excel Tables, Charts in spreadsheet.
8. Decision Making using If, If-Else, Multiple Nested. If-Else statement in spreadsheet application.
9. Intro to PowerPoint 2013, Creating presentation, working with a presentation, Adding & Modifying Slides / texts, Applying & modifying templates.
10. Using color scheme, Drawing & Modifying objects, Images, Links, Producing slideshow, creating a multimedia presentation.
11. Introduction to Computer Networking Fundamentals.
12. Internet Protocol (IPv4)
13. Introduction to Mat-lab, Starting & Editing, Command Windows, History, workspace etc.

Recommended Texts

1. Course Lab Manual.
2. Norton P. (2006). *Introduction to computers* (6th ed.). New Delhi: McGraw-Hill education.

Suggested Readings

1. Vermaat, M. E., Sebok, S. L., Freund, S. M., Campbell, J. T., & Frydenberg, M. (2017). *Discovering computers.* USA: Nelson Education.

ENG-113 **Communication Skills I** **3(3+0)**

The course introduces the students to the underlying rules to acquire and use language in academic context. The course aims at developing grammatical competence of the learners to use grammatical structures in context in order to make the experience of learning English more meaningful enabling the students to meet their real-life communication needs. The objectives of the course are to, reinforce the basics of grammar, understand the basic meaningful units of language, and introduce the functional aspects of grammatical categories and to comprehend language use by practically working on the grammatical aspects of language in academic settings. After studying the course, students would be able to use the language efficiently in academic and real-life situations and integrate the basic language skills in speaking and writing. The students would be able to work in a competitive environment at higher education level to cater with the long-term learners' needs.

Contents

1. Parts of speech
2. Noun and its types
3. Pronoun and its types
4. Adjective and its types
5. Verb and its types
6. Adverb and its types
7. Prepositions and its types
8. Conjunction and its types
9. Phrases and its different types
10. Clauses and its different types
11. Sentence, parts of sentence and types of sentence
12. Synthesis of sentence
13. Conditional sentences
14. Voices
15. Narration
16. Punctuation
17. Common grammatical errors and their corrections

Recommended Texts

1. Eastwood J. (2011). *A basic English grammar*. Oxford: Oxford University Press.
2. Swan M. (2018). *Practical English usage* (8thed.). Oxford: Oxford University Press.

Suggested Readings

1. Thomson, A. J, & Martinet, A. V. (1986). *A practical English grammar*. Oxford: Oxford University Press.
2. Biber, D, Johansson, S., Leech, G Conrad, S Finegan, E., & Quirk, R. (1999). *Longman grammar of spoken and written English*. Harlow Essex: MIT Press.
3. Hunston, S., & Francis, G. (2000). *Pattern grammar: A corpus-driven approach to the lexical grammar of English*. Amsterdam: John Benjamins.

ET-114 **Applied Physics** **4 (3+1)**

This freshman level course has been designed. to provide an introduction to the ideas and concepts of Physics that would serve as a foundation for subsequent electronic engineering courses. The primary objective is to endow the knowled.ge of a wide variety of electric and magnetic phenomena along with their scientific applications, specifically, in the field of electronic engineering. The course initiates with a short review of relevant mathematics, immediately followed. by the basics of electricity at the atomic level. A majority of the course is then dedicated. for electric and magnetic fields, forces, elements and their applications. Additionally, it also aims to provide introductory knowled.ge of wave theory, thermodynamics and semiconductor theory in conjunction with their applications.

Contents

1. Measurement, motion along a straight line, position, displacement and velocity.
2. Vectors and their components, Vectors additions and multiplications, laws of Physics.
3. Motion in two and three dimensions, projectile and circular motion.
4. Force, motion, kinetic energy, work and Newton’s laws of physics.
5. Potential energy, conservation of energy, center of mass, linear momentum and rotation.
6. Torque, angular momentum and gravitation.
7. Oscillations and Waves.
8. First and second law of thermodynamics.
9. Coulomb’s law and electric field.
10. Gauss’s law and electric potential.
11. Capacitance and energy stored. in an electric field.
12. Magnetic field, magnetic field due to current, Ampere’s law and Hall Effect.
13. Induction, Faraday’s Law, Lenz’s Law and energy stored. in a magnetic field.
14. Current, resistance and Ohm’s law.
15. Single-loop circuits, Multi-loop circuits, work, energy and EMF.
16. Kirchhoff's voltage law, Kirchhoff's current law, voltage divider rule and current divider rule.

Recommended Texts

1. Halliday, D., Resnick, R., & Walker, J. (2018). *Fundamentals of physics: extended* (11th ed.).
. United. States: Wiley.

Suggested Readings

1. Young, H. D., & Freedman . (2015). *University physics with modern physics* (14th ed.). United. Kingdom: Pearson.
2. Lorrain. P., Corson, D. R., & Lorrain, F. (2000). *Fundamentals of Electromagnetic Phenomena* (1st ed.). New York: W. H. Freeman.

ET-114 **Applied. Physics (Lab)** **1 (0+1)**

This course, using laboratory practice, describes and illustrates fundamentals of Physics. The primary objective is to endow the knowled.ge of a wide variety of electric and magnetic phenomena along with their scientific applications, specifically, in the field of electronic engineering. The course initiates with a short review of relevant mathematics, immediately followed. by the basics of electricity at the atomic level. A majority of the course is then dedicated. to electric and magnetic fields and their applications. The laboratory emphasizes the practical, hands-on component of this course. It complements the theoretical material presented. in lecture, and as such, is integral and indispensable to the mastery of the subject. There are several items of importance here including proper safety procedures, required tools, and laboratory reports. This exercise will finish with an examination of scientific and engineering notation, the standard form of representing and manipulating values.

Contents

1. Vectors and their components, Vectors additions and multiplications, laws of Physics.
2. Force, motion, kinetic energy, work and Newton's laws of physics.
3. To find out the time period of a simple pendulum.
4. To find out the center of gravity of regular and irregular shapes.
5. Introduction to widely used. components, characteristic curve and error analysis.
6. To find out the resistance by color-coding techniques.
7. Familiarization with analog and digital multimeters.
8. To study ohm's law.
9. Voltage divider and current divider rule.
10. To develop understanding of function generators and oscilloscopes.
11. Characteristics of semiconductor diode: light emitting diodes (LED.'s).
12. Introduction to transistors.
13. Implementation of self-induction and mutual induction of electromagnetism.
14. Demonstration of Faraday's law of electromagnetic induction and Lenz's law.

Recommended Texts

1. Course Lab Manual.
2. Halliday, D., Resnick, R., & Walker, J. (2018). *Fundamentals of physics: extended (11th ed.)* USA: Wiley.

Suggested Readings

1. Young, H. D., & Freedman, R. A. (2015). *University physics with modern physics* (14th ed.). USA: Pearson.
2. Lorrain. P., Corson, D. R., & Lorrain, F. (2000). *Fundamentals of electromagnetic phenomena* (1st ed.). New York: W. H. Freeman.

ET-115 **Engineering Drawing** **2 (1+1)**

The main aim of this course is to study theory and the concept of engineering drawing. This course will equip the students with the basic knowled.ge and skills of engineering drawing and its application in practical scenarios. The students will also be introduced. to the CAD package. Starting from lettering and use of pencils and drawing instruments to the proper technical drawing will be covered. in this course. Plane of projections and four quadrants would be emphasized. Projection of oblique and auxiliary planes practice would be carried. out. Making of loci of points and straight lines would be practiced. Types of solids would be explained. Projection of various solids in simple position and inclined. position would be carried. out. Isometric and pictorial projections of solids/machine parts from where major drawings are made would be carried. out. True shape of section on the auxiliary plane of various solids would be made. Making of freehand sketches from solid objects and from orthographic projections would be practiced. Practice of introduction to computer aided. engineering drawing and use of software/package will be made.

Contents

1 Introduction; Applications and scope of engineering drawing
2 Lines; Types and their usage
3 Dimensioning;
4 Lettering;
5 Orthographic first angle projections
6 Sheet planning
7 Orthographic second angle projections
8 Introduction of computer aided. drawing (CAD);
9 Isometric Projections;
10 Sectional Drawing;
11 Assembly Drawing;

Recommended Texts

1. A. C. Parkinson. (1993). *First year engineering drawing*. USA: Pearson.
2. Shawna Lockhart. (2019). *Tutorial guide to AutoCAD*. USA: SDC Publications.

Suggested Readings

1. N.D. Bhatt. (2011). *Engineering Drawing*. India: Charotar publishing house.

ET-115 **Engineering Drawing (Lab)** **1 (1+1)**

An electrical drawing is a type of technical drawing that shows information about power, lighting, and communication for an engineering or architectural project. This course will equip the students with the basic knowled.ge and skills of engineering drawing and its application in practical scenarios. The students will also be introduced. to the CAD package.

Contents

1. Types of lines lettering
2. Electrical devices symbols Bus Bar
3. Sectionalized. Bus Bar
4. Electrical power distribution system block diagram
5. Hydel power plant block diagram
6. Nuclear power plant block diagram
7. Thermal power plant block diagram
8. Isometric view 1 (Front, Top and Side)
9. Isometric view 2 (Front, Top and Side)
10. Isometric view 3 (Front, Top and Side)
11. Isometric view 4 (Front, Top and Side)

Recommended Texts

Use drawing Sheets and lab works.

ISL-116 **Islamic Studies** **2 (2+0)**

The main aim of this course is to provide Basic information about Islamic Studies, to enhance understanding of the students regarding Islamic Civilization, to improve Students skill to perform prayers and other worships, to enhance the skill of the students for understanding of issues related. to faith and religious life. Introduction to Quranic Studies is involved. in this course. Seerat of our beloved. Holy Prophet (S.A.W) is explained. Introduction To Sunnah: Basic Concepts of Hadith, History of Hadith, Kinds of Hadith, Uloom –ul-Hadith, Sunnah & Hadith, Legal Position of Sunnah will be explained. Islamic Culture & Civilization: Basic Concepts of Islamic Culture & Civilization, Historical Development of Islamic Culture & Civilization, Characteristics of Islamic Culture & Civilization, Islamic Culture & Civilization and Contemporary Issues will also be part of this course. Knowled.ge about Social System of Islam.

Contents

1. Introduction to Quranic Studies
2. Study of Selected. Text of Holly Quran–I
3. Study of Selected. Text of Holly Quran–II
4. Seerat of Holy Prophet (S.A.W) –I
5. Seerat of Holy Prophet (S.A.W) –II
6. Introduction To Sunnah
7. Selected. Study from Text of Hadith Introduction To Islamic Law & Jurisprudence
8. Islamic Culture & Civilization
9. Islam & Science
10. Islamic Economic System
11. Political System of Islam
12. Islamic History
13. Social System of Islam

Recommended Texts

1. Hameed. ullah Muhammad. (2004). *Emergence of Islam*, Islamabad: Adam Publishers.
2. Hameed. ullah Muhammad. (1992). *Muslim Conduct of Stat*. Islamabad: Kazi Pubns Inc.

Suggested Readings

1. Hameed. ullah Muhammad. (1959). *Introduction to Islam*. Islamabad: IRI.
2. Hussain Hamid Hassan. (2010). *An Introduction to the Study of Islamic Law*. Islamabad: leaf Publication.
3. Ahmad Hasan. (1993). *Principles of Islamic Jurisprudence*. Islamabad: Islamic Research Institute, International Islamic University.

EET-121 **Basic Electronics** **3 (3+1)**

This subject is intended. to provide students with the fundamentals of semiconductor physics and its application to common semiconductor devices. The course starts with an in-depth look at the theory of semiconductors including energy gap, mobility of electrons and holes, influence of temperature on conductivity, doping, photoconductivity, drift and diffusion of charge carriers and the ideal diode equation, diode models. Then, properties of the abrupt p-n junction are studied. and applied. to various practical devices including the signal diode, zener diode, varactor diode, photodiode, light-emitting diode, bipolar junction transistor, and finally field effect transistors. Moreover, application of diode as rectifier, clipper and clampers are studied. in it. BJTs and FETs along with its biasing, types and configurations are studied. in detail in the course. OP-AMP based. circuits widely used. in different applications are studied.

Contents

1. Semiconductor Devices, intrinsic and extrinsic materials, P-type and N-type materials
2. PN junction , diode, diode models, diode forward and reverse x-istics, breakdown voltage.
3. Semiconductor Diodes: Photodiode, Schottky barrier diode, Zener diode
4. Diode application: Half wave rectifier, Full wave center tapped. rectifier
5. Diode applications: Full wave bridge rectifier , voltage doubler
6. Diode applications: Clippers series, Clampers, parallel clippers
7. Basics of BJTs and working principle
8. BJT characteristics and basic parameters
9. DC biasing of BJT using voltage divider circuit , Load line and Q point Concepts
10. BJT as an amplifier and as switch
11. BJT configurations: CE, CB, CC configurations
12. Basic of FET construction and working principle
13. FET types: JFET(N TYPE, P TYPE) , MOSFET(E-MOS, D-MOS), characteristics and paramters
14. DC biasing of FET(JFET (self-bias, voltage divider bias), MOSFET(drain feedback bias, voltage divider bias))
15. FET configurations; CD,CG,CS configurations and their comparison
16. Introduction to OP-AMP inverting and non-inverting configurations
17. OP-AMP based. circuits ; Comparator, summing amplifier, Differentiator, Integrator

Recommended Texts

1. Thomas L Floyd. (2018). *Electronic Devices*. UK: Pearson Prentice Hall.

Suggested Readings

1. Albert Malvino and David Bates. (2015). *Electronic Principles*. New York: McGraw-Hill.

ET-121 **Basic Electronics (Lab)** **1(3+1)**

The objective of this lab work is to explain the basic concepts of semiconductor diode and its current-voltage relationship. Various applications of junction diodes are implemented., like power supplies, Clippers, Clampers. Advancement of Bipolar Junction Transistors (BJTs) and Field-Effect Transistors (FETs) as two PN-junction devices is discussed. Relationship between currents and voltages in these transistors are analyzed. in detail. The working principles of Op-Amps and MOSFETS are also analyzed. in detail. A variety of applications of various types of transistors, Op-Amps and MOSFETS are analyzed.

Contents

1. Introduction to Laboratory Equipment
2. Characteristics of P-N Junction diode
3. Half wave Rectifier With and Without Filters
4. Full wave Rectifier With and Without Filters
5. Biased. series and parallel Clipper circuits
6. Biased. series and parallel Clamper circuits
7. Characteristics of Zener diode and Regulations
8. Output Characteristics and Operating Regions of BJTs
9. Common Emitter Amplifier Configuration
10. JFET Drain and Transfer Characteristics
11. Op-amp as inverting amplifier
12. Op-amps non-inverting amplifier
13. Design Project

Recommended Texts

1. Thomas L Floyd. (2018). *Electronic devices*. UK: Pearson.

Suggested Readings

2. Albert Malvino and David Bates. (2015). *Electronic principles*. New York: McGraw-Hill.

MATH-122 **Applied. Mathematics-II** **3 (3+0)**

This course introduces the theory, solution, and application of ordinary differential equations. Topics discussed. in the course include methods of solving first-order differential equations, existence and uniqueness theorems, second-order linear equations, power series solutions, higher-order linear equations, systems of equations, non-linear equations, Sturm-Liouville theory, and applications. The relationship between differential equations and linear algebra is emphasized. in this course. An introduction to numerical solutions is also provided. Applications of differential equations in physics, engineering, biology, and economics are presented. The goal of this course is to provide the student with an understanding of the solutions and applications of ordinary differential equations. The course serves as an introduction to both nonlinear differential equations and provides a prerequisite for further study in those areas.

Contents

1. Differential equation; Basic concepts and ideas
2. Geometrical interpretation of first and second order differential equations
3. Separable equations, equations reducible to separable form
4. Exact differential equations, integrated. factors.
5. Linear first order differential equations, Bernoulli's differential equation.
6. Families of curves, orthogonal trajectories
7. Applications of differential equations of first order to relevant engineering systems.
8. Homogeneous linear differential equations of second order
9. Homogeneous equations with constant coefficients
10. The general solutions, initial and boundary value problems
11. D- Operator, complementary functions and particular integrals
12. Real, complex and repeated. roots of characteristics equations
13. Cauchy equation, non- homogeneous linear equations.
14. Applications of higher order linear differential equations.
15. Ordinary and regular points and corresponding series solutions
16. Concept of sequence and series.

Recommended Texts

1. Kreyszig, E. (2014). *Advanced. engineering mathematics* (10^{th} ed.). USA: Willey.
2. Zill, D.G., Michael, R. (2009) *Differential equations with boundary-value problems* (5^{th} ed.) USA: Brooks/Cole.

Suggested Readings

1. Arnold, V.I. (1991). *Ordinary differential equations* (3^{rd} ed.). New York: Springer.
2. Apostol, T. (1969).*Multi Variable Calculus and Linear Algebra* (2^{nd}ed.). US: John Wiley and sons.
3. Boyce, W.E., Diprima,R.C. (2012). *Elementary differential equations and boundary value problems* (10^{th}ed.) US: John Wiley & Sons.

ENG-123 **Communication Skills II** **3(3+0)**

The course aims at developing linguistic competence by focusing on basic language skills in integration to make the use of language in context. It also aims at developing students' skills in reading and reading comprehension of written texts in various contexts. The course also provides assistance in developing students' vocabulary building skills as well as their critical thinking skills. The contents of the course are designed. on the basis of these language skills: listening skills, pronunciation skills, comprehension skills and presentation skills. The course provides practice in accurate pronunciation, stress and intonation patterns and critical listening skills for different contexts. The students require a grasp of English language to comprehend texts as an organic whole, to interact with reasonable ease in structured. situations, and to comprehend and construct academic discourse. The course objectives are to enhance students' language skill management capacity, to comprehend text(s) in context, to respond to language in context, and to write structured. response(s).

Contents

1. Listening skills
2. Listening to isolated. sentences and speech extracts
3. Managing listening and overcoming barriers to listening
4. Expressing opinions (debating current events) and oral synthesis of thoughts and ideas
5. Pronunciation skills
6. Recognizing phonemes, phonemic symbols and syllables, pronouncing words correctly
7. Understanding and practicing stress patterns and intonation patterns in simple sentences
8. Comprehension skills
9. Reading strategies, summarizing, sequencing, inferencing, comparing and contrasting
10. Drawing conclusions, self-questioning, problem-solving, relating background knowled.ge
11. Distinguishing between fact and opinion, finding the main idea, and supporting details
12. Text organizational patterns, investigating implied. ideas, purpose and tone of the text
13. Critical reading, SQ3R method
14. Presentation skills, features of good presentations, different types of presentations
15. Different patterns of introducing a presentation, organizing arguments in a presentation
16. Tactics of maintaining interest of the audience, dealing with the questions of audience
17. Concluding a presentation, giving suggestions and recommendations

Recommended Texts

1. Mikulecky, B. S., & Jeffries, L. (2007). *Advanced. reading power: Extensive reading, vocabulary building, comprehension skills, reading faster*. New York: Pearson.
2. Helgesen, M., & Brown, S. (2004). *Active listening: Building skills for understanding*. Cambridge: Cambridge University Press.

Suggested Readings

1. Roach, C. A., & Wyatt, N. (1988). *Successful listening*. New York: Harper & Row.
2. Horowitz, R., & Samuels, S. J. (1987). *Comprehending oral and written language*. San Diego: Academic Press.

ET-124 **Linear Circuit Analysis** **3 (3+1)**

Linear Circuit Analysis is the first course of the three-course sequence covering the electric circuits and electronics stream. The course provides the undergraduate students with the foundation of basic laws, theory of linear electric circuits with passive elements and AC fundamentals. This course introduces concepts of charge, current and voltage to be followed. with the description of current and voltage sources. An introduction to networks and circuits is accompanied. by detailed. discussion of Ohm's law and the Kirchhoff's laws. Circuit analysis techniques using Nodal and Mesh Analysis, important theorems like source transformation, superposition, Thevenin's, Norton's, reciprocity theorem and maximum power transfer theorem and Delta-Wye conversion. Second portion of this course introduces capacitance, inductance, and their series & parallel combination. First order RL, RC Circuits and second order RLC circuits are also taught to find the transient and steady state response of these kinds of circuits. Some Basic introductions of AC are also covered.

Contents

1. Basic concepts: units, voltage, current, power and energy, independent and dependent sources
2. Basic laws: introduction, ohm's law, nodes, branches, and loops, kirchhoff's laws, series resistors and voltage division, parallel resistors, and current divisions
3. Wye-delta transformations, delta to wye conversion, wye to delta conversion
4. Methods of analysis: introduction, nodal analysis, nodal analysis with voltage source
5. Mesh analysis, mesh analysis with current source
6. Circuits theorems: introduction, linearity property, superposition theorems
7. Source transformation, thevenin's theorems, norton's theorem
8. Maximum power transfer theorem, reciprocity theorem
9. Capacitors and inductors: capacitors, inductors, series & parallel capacitors and inductors
10. First order circuits: introduction, the source-free RC Circuit, the source-free RL circuit
11. Step response of an RC circuit, step response of an RL circuit
12. Second order circuit: introduction, the source-free series RLC circuit
13. The source-free parallel RLC circuit
14. AC fundamentals: sinusoids, phasor with circuit Elements, impedance, and admittance
15. AC power analysis: introduction, instantaneous and average power, effective or RMS Value
16. Three-phase circuits: introduction, balanced. three-phase voltages

Recommended Texts

1. Sadiku, M. N., & Alexander, C. K. (2007). *Fundamentals of electric circuits* (5th Ed.). New York: McGraw-Hill Higher Education.

Suggested Readings

1. Hayt, W. H., Kemmerly, J. E., & Durbin, S. M. (1986). *Engineering circuit analysis* (8th Ed.). New York: McGraw-Hill.
2. Hughes, E., Hiley, J., Smith, I. M., & Brown, K. (2005). *Hughes electrical and electronic technology* (Latest Edition).USA: Pearson education.
3. Floyd, T. L. (2004). *Electric circuits fundamentals* (4th Ed.). UK: Prentice Hall.

ET-124 Linear Circuit Analysis (Lab) 1 (3+1)

The basic aim of this course is to introduce students to the fundamental theory and practical for the analysis of Direct Current (DC) and Alternating Current (AC) electrical circuits using different components and Lab equipment. This course provides the undergraduate students with the foundation of basic laws, theory of linear electric circuits with passive elements and AC fundamentals and understanding the Phasors diagram and Phase difference.

Contents

1. Demonstration of Ohm‟s law, Kirchoff‟s voltage and current laws
2. Demonstration of Superposition, Thevenin and Norton theorems with DC sources
3. Study of phase displacement using oscilloscope
4. Draw phasor diagrams for RL, RC and RLC circuits
5. Determine power factor for inductive and capacitive loads
6. Calculation and demonstration of RMS, average and peak values of a periodic waveform using signal generator and oscilloscope
7. Determine active and reactive power for single phase circuits
8. Determine active and reactive power for three phase circuits
9. Demonstration of series and parallel resonance in R, L and C circuits

Recommended Texts

1. C. Alexander and M Sadiku. (1986). *Fundamentals of electric circuits*. New York: McGraw- Hill.

Suggested Readings

1. Hayt, W. H., Kemmerly, J. E., & Durbin, S. M. (1986). *Engineering circuit analysis*. New York: McGraw-Hill.
2. Floyd. (2009). *Circuit Analysis, (8th ed.).* London: Pearson UK.

ET-125 **Basic Mechanical Technology** **4 (3+1)**

The main aim of this course is to provide a platform for students to understand the basics of Mechanical Technology such as forces, types of forces, moments and couples and stresses like shear stresses and strain etc. Students are also taught to analyze loading on different types of beams. This is one of the fundamental courses which are required. for students to understand the basics of mechanical technology.

Contents

1. Force, Types of Force
2. Effects of force on various mechanical and structure members,
3. Moment of force
4. Couple of force
5. Equilibrium
6. Simple stress
7. Shear stress
8. Bearing stress
9. Bending moment and shearing force Bending Stresses
10. Deflection of beams
11. Torsion of bars of circular cross section
12. Design of shafts
13. Pulleys, flywheels
14. Bearing and couplings
15. Power Transmission belts, spur gears and friction clutches

Recommended Texts

1. F.L. Singer. (1987). *Strength of Materials*. USA: Harpercollins College Div.
2. Thomas Beven. (2005). *Theory of Machine*. USA: College book store.

Suggested Readings

1. F.P. Beer and Johnston. (2014). *Mechanics of Materials*. USA: McGraw Hill.

ET-125 **Basic Mechanical Technology (Lab)** ***1(0+1)***

Basic Mechanical Technology, as its name suggests, deals with the mechanics of operation of mechanical systems. This is the branch of engineering which includes design, analysis, testing and maintenance of mechanical systems. Within the practical sciences, the course is useful in formulating new ideas and theories, discovering and interpreting phenomena, and developing experimental and computational tools. The basic purpose of studying BMT is to develop the conceptual and practical skills regarding time, moment, forces, their actions, reactions as well as force systems and implement the theoretical knowled.ge into finding practically observed. and gathered. results.

Contents

1. Force and its types, Effects of force on various mechanical and structure members, Equilibrium
2. Study of UTM
3. Tensile test on UTM
4. Simple stress
5. Shear stress, Hooke's law and its verification
6. Bearing stress
7. Young's modulus, Bulk modulus and their verification
8. Bending moment and shearing force Bending Stresses
9. Deflection of beams, Torsion of bars of circular cross section
10. Flywheel
11. Mechanical efficiency and power of gear train
12. Design of shafts, pulleys, bearings and couplings
13. Power transmission by belts, spur gears and friction clutches
14. Deflection of beams
15. Torsion of bars of circular cross section

Recommended Texts

1. Prof. Paul D. (2019). Ronney *Basics of Mechanical Engineering*. USA: McGraw Hill

Suggested Readings

1. Crustar Nieman, (1978) *Machine elements design and calculations in mechanical engineering*. Berlin: Springer International.
2. F.P. Beer and Johnston. (2014). *Mechanics of Materials*. USA: McGraw Hill.
3. Thomas Beven. (2005). *Theory of Machine*. USA: College book store.
4. F.L. Singer. (1987). *Strength of Materials*. USA: Harpercollins College Div.

MATH-211 **Applied. Mathematical III** **3 (3+0)**

The main aim of this course is to review the knowled.ge and practice the skills acquired. in diploma Courses, to understand the concept of matrices and determinants, to understand the concept and use of partial differential equations and their applications. Laplace transforms numerical methods, boundary value and initial value problems, qualitative analysis of solutions, and applications of differential in solving engineering problems. Differential equations basic concepts and ideas would be involved. like geometrical interpretation of first and second order differential equations (D.E). Linear first order differential equations and Bernoulli's differential equation would be studied. Families of curves, orthogonal trajectories, and applications of differential equations of first order to relevant engineering systems would be analyzed.

Contents

1. Linear Algebra: Basic concepts of matrices and determinants, addition, subtraction, multiplication
2. linear system of equations and their solutions, Gauss elimination technique
3. Row red.uced. Echelon form, Rank of the matrices, Inverse of matrices
4. Gauss Jordan method, Determinants, Crammers rule, Eigenvalues and Eigenvectors
5. Vector differential calculus, Gradient, Divergence, and curl, and concepts of vector integral calculus
6. Partial Differential equations: Fourier series, Basic concepts of Partial Differential Equations
7. Wave equation, Heat Equation, Laplace's equation
8. Poisson Equation and their solutions by using Fourier Series, and Laplace transforms.

Recommended Texts

1. C.R. Wylie. (1995). *Advanced engineering mathematics (6th ed.).* USA: McGraw- Hill Education.
2. Erwin Kreyszig. (2010). *Advanced engineering mathematics (10th ed.).* USA: John Wiley & Sons

Suggested Readings

1. Smith, D. Eggen, M. and Andre R.S. (2014). *A Transition to advanced mathematics.* Brooks/Cole.

ET-212 **Network Analysis** **3 (3+0)**

The main aim of this course is to enable students to learn advanced. circuit solving skills. The concept of complex frequency, single-phase circuit analysis, Phasors, impedance, star-delta transformation, and Application of Laplace Transforms in circuits analysis. After successful completion of this course, the student should be able to: Use Kirchhoff's laws, circuit theorems, and node voltage methodology to solve. AC circuit, 2nd order transient circuits. Apply steady state sinusoidal analysis to circuits. Understanding of phasors diagrams for AC circuit analysis. Understanding of the transformer operation. Apply Laplace Transformation and two-port networks. The main objective is to make students familiar with the modern hierarchy of AC circuit examination and explain to them the state-of-the-art electrical network analysis.

Contents

1. AC Circuit Analysis: Loop and node analyses for AC circuits
2. Power factor, power factor improvement
3. Transients in RL, RC and RLC circuits
4. AC Network Theorems: Superposition, Thevenin, Norton
5. Reciprocity and maximum power transfer theorem
6. Poly-Phase Circuits: Star and Delta connections and conversions
7. Voltage, current and power calculations
8. Electric Filters: RC low pass and high pass filter circuits
9. Band pass and band stop filters

Recommended Texts

1. Boylested., (2015). *Introductory Circuit Analysis* (13^{th} ed.). UK: Pearson
2. Floyd, (2016) *Circuit Analysis*. UK: Pearson

Suggested Readings

1. W. Hayt. (2011). *Engineering of Circuit Analysis*. USA: McGraw-Hill Education.
2. K. Y. Tang. (1940) *Circuit Analysis*. USA: International Textbook Company.

ET-212 **Network Analysis (LAB)** **1 (3+1)**

The main aim of this course is to enable students to learn advanced. circuit solving skills. The topics to be covered. include Laplace transform, analysis using Phasors and Laplace transform, Introduction to Bode plots and frequency response analysis using Fourier Transform, single and three phase ac power systems, Two-port Networks Parameters. Thus lab will cover the experiments to make students understand the use of phasor techniques to solve the circuits, to study pulse and steady state responses, and to draw and use bode plot for frequency responses of single phase circuits, to understand basic concepts related. to series and parallel connection of RL, RC and RLC circuits. It is expected. from the students at the end of semester to implement, build and test group project in a team environment with minimal direction from the instructor

Contents

1. Verification of mesh and nodal circuit methods for AC analysis.
2. Observe variation of impedance and current in RLC series circuit with changes in frequency.
3. Study and observe transient responses of R, L, C circuits with the help of oscilloscopes.
4. Demonstration of Superposition, Thevenin and Norton theorems with AC sources.
5. Demonstration of maximum power transfer theorem with AC sources.
6. Study of Star and Delta connection.
7. Demonstrations of RC low pass filter circuits.
8. Demonstration of RC high pass filter circuits

Recommended Texts

1. Boylested., (2015). *Introductory Circuit Analysis* (13th ed.). UK: Pearson
2. Floyd, (2016). *Circuit Analysis*. UK: Pearson
3. W. Hayt. (2011). *Engineering of Circuit Analysis*. USA: McGraw-Hill Education.
4. K. Y. Tang. (1940). *Circuit Analysis*. USA: International Textbook Company.

ET-213 **Digital Electronics (Th.)** **3(3+0)**

This course provides an introduction to the control of engineering systems using microprocessors, sensors and actuators. Within this context it introduces the fundamentals of combinational logic, Boolean algebra, digital arithmetic, combinational logic and sequential logic. The course is designed. to be one of the first undertaken by new students in electrical and electronic engineering such that its successful completion will provide the necessary foundation for more specialists learning in digital microelectronics and computer engineering.

Contents

1. Number Systems, Decimal to Binary conversions
2. Binary Arithmetic
3. Boolean algebra
4. Switching devices, logic gates, AND, OR, NOT, XOR, XNOR gate circuits
5. NAND, NOR gate circuits
6. Modular implementation of combinational logic circuits
7. K-maps& truth tables
8. Different logic families: TTL, Emitter Coupled. Logic, NMOS, CMOS.
9. Combinational logic circuits: adders, comparator, encoder, decoder.
10. Multiplexer, de-multiplexer. A/D and D/A converter
11. Introduction to Sequential Circuits, SR Latch
12. SR Flip flops, their characteristics and transition tables for sequential circuit design
13. D Flip flops, their characteristics and transition tables for sequential circuit design
14. JK Flip flops, their characteristics and transition tables for sequential circuit design
15. T Flip flops, their characteristics and transition tables for sequential circuit design
16. Counters.
17. Registers.

Recommended Texts

1. Mano, M. M. (2017). *Digital logic and computer design*. India: Pearson Education.

Suggested Readings

1. Floyd, T. L. (2010). *Digital Fundamentals* (10th ed.). India: Pearson Education.

ET-213 **Digital Electronics (Lab)** **1 (3+1)**

The aim of the course is to understand the design & analyzing the digital logic circuits & basic software tools for the design and implementation of digital circuits. The objectives of this course are to introduce the concept of digital and binary systems and further topics that include Logic Simplification, Combinational Logic, and Sequential Logic, Latches, Flip-Flops and their applications. Adders, Multiplexers, Counters, and Shift Registers. Design and implementation of combinational circuits explain the state-of-the- art digital logic design.

Contents

1. Study the characteristics of a Transistor as a switch.
2. Construction of a NOT gate using TTL.
3. Construction of AND and OR gates.
4. Construction of NAND and NOR gates.
5. Construction of adder and comparator.
6. Construction of Analog to Digital and Digital to Analog convertors.
7. Study the operation and truth tables of S-R, D, JK and T flip-flops.
8. Study of encoder/decoder circuits.
9. Study of multiplexer/de-multiplexer circuits.
10. Study and construction of digital counters.

Recommended Texts

1. M. Morris Mano and Micheal D. Ciletti (2013). *Digital design: an introduction to the Verilog HDL, (*5th ed.). *New Jersey:* Prentice Hall.

Suggested Readings

1. Floyd, T. L. (2010). *Digital fundamentals* (10thed.). London: Pearson England.

ET-214 Power Generation and Utilization 4 (3+1)

This course is to learn about different generating power plants such as Hydro-electric, wind, thermal, gas, solar thermal, nuclear plants and geothermal. The course will also focus on the comparison between different generating power plants according to their running and fixed. costs, their typical ramp, economics and electrical loads in power systems, environmental impacts of power generation and will look at alternative and sustainable generation systems.

Contents

1. World Energy Situation and Energy Resources in Pakistan
2. Methods of Energy Conversion
3. Development of Energy resources
4. Economics and electrical load in Power Generation
5. Working Principle of Thermal Power Generation
6. Site Selection, Design and General Layout of Thermal Power Plant
7. Efficiency and Cost of Thermal Power Generation
8. Design and Operation of Gas Turbine Power Plant
9. Efficiency and Cost of Gas Turbine Power Plant
10. Working Principle of Hydro-Electric Power Plant
11. Site Selection of Hydro-Electric Power Plant
12. Design and Layout of Hydro-electric Power Plant
13. Working principle of Nuclear power stations
14. Comparison of Nuclear with other power stations
15. Design of Nuclear power stations
16. Layout of Nuclear power stations
17. Safety issues in Nuclear power stations
18. Control system of radioactive waste
19. Electrical Energy Utilization: Design techniques for electrical wiring for domestic and industrial applications and Cable selection
20. Electrical Heating: Resistive, inductive and dielectric heating, electric furnaces.

Recommended Texts

1. Soni, Gupta, Dhanpat Rai, P.R. (1987). *A course in Electrical Power (9th ed.)*. India: S K Khatria
2. Deshpande. (1985). *Principles of Power Generation*. India: PHI publisher.

Suggested Readings

1. S. L. Uppal, P.R(1985). Electrical Power (11th ed.). India: Khanna
2. V. K. Mehtha, R. Mehtha, P.E. (2005). *Principles of Power System (4th ed.)*. India: S. Chand

ET-214 **Power Generation and Utilization Lab** **4 (3+1)**

Process techniques for electricity and heat generation; Measurement and arrangement of energy balances and characteristic curves; Technical criteria for energetic assessment of process control; steam turbine process, lamp measurement, combined. heat and power, fuel cell etc.

Contents

1. Electrical Safety & Precaution
2. Introduction to Power Generation Trainer
3. Familiarization of Energy Analyzer Functionality with Load
4. Understand Basics of Power Generation
5. Investigate Voltage Regulation by Direct Method
6. Analyze Regulation of Alternator by Open Circuit and Short Circuit Test
7. Investigate Slip Test for the Measurement of Synchronous Machine Constants
8. Find out Characteristics of Resistive, Capacitive and Inductive Load with Generator Trainer
9. Analyzing the Synchronization by Two Bright and One Dark Lamp Method
10. To Check the Working of Synchro scope
11. Familiarization with Synchronization of Two Parallel Systems by Dark Lamp Method
12. Determine the Working of Three Phase Watt Meter
13. Working of Tachometer in Order to Measure Rpm of Synchronous Generator
14. To perform and Analyze Residential Electrical wiring.
15. Design a proper illumination scheme for a given workplace using standard software DIALUX.

Recommended Texts

Use Power Generation Lab Manual.

ET-215 **Electrical Machines - I** **4 (3+1)**

The base for almost all electrical and electro-mechanical machines is the phenomenon of electromagnetism. This course is designed. to give an in-depth concept of the phenomenon of electromagnetism and the related. laws like electromagnetic induction. After this comprehensive study the course will provide an introduction to basic machines, DC motors and generators, having electromagnetic induction as their basic operation principle. In addition, the transformers will also be discussed.

Contents

1. Electromagnetism: Magnetic circuits, magnetically induced. EMF, losses in magnetic circuits, magnetic fields in rotating machines, generated. voltage, torque and force.
2. DC Motors: Principle of operation, back EMF, torque equation, types of DC motors, speed.-torque characteristics, speed. control, applications.
3. DC Generators: Constructional features and principle of operation, EMF equation, excitation types, load and no-load characteristics, commutation, armature reaction.
4. Transformers: Principle of operation, constructional features of single and three phase transformers, EMF equation, transformer on no-load and load, three phase transformer connections, auto-transformers.
5. Testing of DC machines and transformers: Losses and efficiency, testing of DC machines and different types of tests.

Recommended Texts

1. S. J. Chapman. (2012). *Electrical Machinery Fundamentals (5th ed.)*. New York: McGraw Hill

Suggested Readings

1. H. R. Hiziriglu and B. S. Guru. (2011). *Electric Machinery and Transformers* (3rd ed.). Oxford: Oxford University Press.
2. A. E. Fitzgerald, E. F. Arthur, K. Charles and S. D. Umans. (2003). *Electric Machinery* (6th ed.). New York: McGraw Hill.

ET-215 Electrical Machines-1 Lab 1(3+1)

The objective of the Electrical Machines Laboratory is to portray the concepts of DC machines to students. As far as DC machines are concerned., it deals with the working principle of DC machines and different types including operation as generator and motor. Furthermore, terminal and torque speed. characteristics of DC generators and motors are discussed. respectively.

Contents

1. Introduction to the working principle of a dc machine and its various parts.
2. Determine armature and field resistance of a DC shunt generator.
3. Plot open circuit characteristics of a DC shunt generator.
4. Perform the load test of a DC shunt generator.
5. Perform the load test of a DC series generator.
6. Perform the load test of a DC compound generator.
7. Determine torque speed. characteristics of a DC series motor.
8. Analyze torque speed. characteristics of a DC shunt motor.
9. Analyze torque speed. characteristics of a DC compound motor.

Recommended Texts

1. Stephen J. Chapman, (2011). *Electric machinery fundamental (5th ed.)*. USA: McGraw- Hill International Ed.ition

Suggested Readings

1. A.E. Fitzgerald. (2003). *Electric machinery.* (6th ed.). New York: McGraw-Hill International Ed.ition.
2. Charles I. Hubert, P.R. (2001). *Electric machines: theory, operating applications, and controls* (2nd ed.). United States: Prentice Hall.

ET-221 **Instrumentation and Measurements** **4 (3+1)**

Conducting experiments and making measurements is an essential aspect of all branches of science and engineering. Nearly all of our current quantitative understanding of the natural and engineered. world has come from the interplay between theory and measurements. Models and simulations of systems require experimental validation and performance of engineered. systems must not only be predicted., but also measured. and tested. In this course students will learn the basic terminologies related. to measurement system design, instrument types, statistical analysis, and types of error in measurement. The course then covers different electronic and digital measuring instruments, e.g. Digital and Analog meters, Oscilloscopes, Signal Generators, Bridges, Transducers and sensors are included. It also equips the students with mathematical techniques and skills to handle the instruments in industry.

Contents

1. Fundamentals of measurements systems, measurements system design and applications.
2. Instruments types (Active and Passive, Null and Deflection, Analog and Digital type instruments) and their applications.
3. Instruments static performance characteristics.
4. Instruments dynamics performance characteristics.
5. Measurement uncertainty, sources of systematic error, reduction of systematic errors.
6. Quantification of systematic errors.
7. Types of Bridges for measurement of resistance.
8. Types of Brides for measurement of Inductance and Capacitance.
9. Signal conditioning (Filtering and Amplification).
10. Signal conditioning (Rectification and ADC/DAC).
11. Analog/Digital, power and energy meters.
12. Oscilloscopes and Function generator working and their applications.
13. Transducers (Strain Gauge, Thermistors and Thermocouple).
14. Transducers (LVDT, Force and pressure transducers).
15. Sensors, choosing a sensor and need. for sensors.
16. Sensors types (Motion, temperature, light, Magnetic field and Ultrasonic sensors).

Recommended Texts

1. Morris, A. S., & Langari, R. (2015). *Measurement and instrumentation theory and application (2nd ed.).* United States: Academic Press.

Suggested Readings

1. Klaassen, K. B., & Gee, S. (1996). *Electronic measurement and instrumentation* (2nd ed.). United. Kingdom: Cambridge University Press.
2. Helfrick. A. D., & Cooper, W. D. (1989). *Modern electronic instrumentation and measurement technology*. NJ: Prentice Hall.

ET-221 Instrumentation and Measurements (Lab) 1 (0+1)

This course, using laboratory practice, describes and illustrates fundamentals of measurements and measuring instruments related. to engineering. The objective of this Lab is to help students understand the use of sensors, transducers and measuring instruments. The laboratory emphasizes the practical, hands-on component of this course. It complements the theoretical material presented. in lecture, and as such, is integral and indispensable to the mastery of the subject. There are several items of importance here including proper safety procedures, required. tools, and laboratory reports. This exercise will finish with an examination of scientific and engineering notation, the standard form of representing and manipulating values.

Contents

1. Working and characteristics of various types of meters.
2. Measurement of Unknown Resistance by using Wheatstone Bridge Method.
3. Measurement of the low resistance by using Kelvin Double Bridge Method.
4. Describe the construction and characteristics of temperature transducer.
5. Describe the construction and characteristics of platinum R.T.D resistance transducer.
6. Describe the construction and characteristics of a thermocouple.
7. Describe the construction and characteristics of an NTC thermistor.
8. Describe the characteristics of The Linear Variable Differential Transformer (LVDT) transducer.
9. Describe the construction and characteristics of an air flow transducer.
10. Describe the construction and characteristics of an air pressure transducer.
11. Discuss the characteristics of NTC thermistor bridge circuits.
12. Characteristics of an ON/OFF Temperature Control System.
13. Introduction to LabVIEW.
14. Study of Data Acquisition system using LabVIEW Software.
15. Design Project.

Recommended Texts

1. Course Lab Manual.
2. Alan S. Morris and Reza Langari. (2015). *Measurement and instrumentation theory and application* .MA USA: Elsevier.

Suggested Readings

1. Klass B. Klaassen and Steve Gee. (1996). *Electronic measurement and instrumentation.* UK: Cambridge University Press.

ET-222 **Electrical Machines II** **4 (3+1)**

This course is intended. to provide a basic introduction to the theory of electromechanical energy in the context of AC machines. In depth analysis of synchronous generator & induction motors will be carried. out for different characteristics. Single phase AC fractional-horsepower motors will also be covered. in the course with introduction of split phase, shaded. pole, universal and repulsion motors.

Contents

1. Induction Motor: Construction, working, principle, torque development, types, merits, demerits, rotor slip and rotor frequency, and calculation.
2. Equivalent Circuit of Induction Motor: Equivalent circuits, rotor circuit, slip effects and final equivalent circuit.
3. Power and Torque Calculations: Power flow diagram, losses, rotor currents, characteristics.
4. Speed. Control of Induction Motor: Pole changing method, Line frequency method and Voltage control method
5. Starting: Wye-delta starter, Auto transformer starter, Resistance starting, Soft starting and Rotor resistance starting control
6. Synchronous Motor: Construction, working, principle of operation, Torque speed. characteristics, V-curves and Application in power factor improvement
7. Universal Motor: Construction, principle of operation and application
8. Shaded-Pole Motor: Construction, principle of operation and application
9. Split-Phase Motor: Construction, principle of operation and application
10. Repulsion Motor: Construction, principle of operation and application
11. Single phase Machines: Speed. Control methods, Starting methods
12. Induction Generator: Basic principle, working and construction, Voltage build up phenomenon in stand-alone system and Applications
13. Synchronous Generator: Basic principle and working, Salient pole and cylindrical rotors and their comparison, Brushless exciters and pilot exciters, Application of synchronous generators and Synchronous speed. expression
14. Synchronous Generator Equivalent Circuit: Equivalent circuit of synchronous generator Armature resistance and leakage inductance, Phasor diagrams at different power factor loads and Derivation of power expressions
15. Synchronous Generator Modes of Operations: Working alone, working in parallel with same SG, and connected. to infinite bus bar, House diagram and sharing of power and Synchronization of alternator with infinite bus bar

Recommended Texts

1. Stephen J. Chapman, (2011). *Electric machinery fundamental (5th ed.)*. USA: McGraw- Hill International Edition.

Suggested Readings

1. A.E. Fitzgerald. (2005). *Electric machinery* (6th ed.). USA: McGraw-Hill.

2. Charles I. Hubert, P.R.(2001). *Electric machines: theory, operating applications, and controls (2^{nd}ed.)*. UK: Prentice Hall.

ET-222 **Electrical Machines-2 Lab** **1(3+1)**

The objective of the AC Machines Laboratory is to portray students to the concepts of single phase and three phase transformers, synchronous and asynchronous machines and analyze their performance. It aims to impart knowled.ge on construction, performance and principle of operation of ac machines.

Contents

1. Perform open circuit and short circuit test on single phase transformer and determine parameters of its equivalent circuit
2. Perform back to back test on two identical single-phase transformer and find efficiency
3. Study 3 phase transformers and implement its various connections star/star, star/delta, delta/star and delta/delta.
4. Study about the construction and different parts of induction Motor
5. Perform the block rotor and no-load test on single phase induction motor
6. Perform open circuit and short circuit test on three phase alternators and draw open and short circuit characteristics.
7. Determine voltage regulation of an alternator by zero power factor method.
8. Study about the construction and different parts of synchronous Motor
9. Study the effect of variation of field current upon the stator current and power factor with synchronous motor running at no load draw voltage and inverted. voltage curve.
10. Find out synchronization of an alternator with an infinite bus by dark lamp method.

Recommended Texts

1. Stephen J. Chapman, (2011). *Electric machinery fundamental (5th ed.)*. USA: McGraw- Hill International Edition.

Suggested Readings

1. A.E. Fitzgerald. (2005). *Electric machinery* (6th ed.). USA: McGraw-Hill International Edition
2. Charles I. Hubert, P.R. (2001). *Electric machines: theory, operating applications, and controls (2nd ed.)*. UK: Prentice Hall

ET-223 **Power Transmission** **4 (3+1)**

The main aim of this course is to study theory and the concept of electrical power transmission. This course introduces basic concepts of relationship of level of voltages and other physical parameters for electrical power transmission. This course also covers the factors (Electrical and environmental) which curb the amount of electrical power being transmitted. Transmission of electrical energy is an inevitable phenomenon. However, a large amount of power is lost due to a number of factors. This course will enable students to understand the basics of power transmission as well as analyzing the factors and parameters affecting efficient and reliable flow of power.

Contents

1. Introduction; Level of transmission and types, voltages for transmission in Pakistan and world
2. Basic electrical power system concepts; Node equations, One-Line diagram, Per-Unit System
3. Conductors; materials, types and properties of different types of conductors
4. Transmission Line Parameters; Resistance, Skin Effect, Proximity Effect, Inductance
5. Transmission Line Parameters; Conductance, Capacitance, Ferranti Effect
6. Mechanical Design; Support structure, insulators, sag and tension, wind and ice loading
7. Insulators; Materials, Types of insulators, voltage distribution across string, string efficiency
8. Corona Effect; Formation of corona, loss, radio interference
9. Distribution System; Types of distributors, analysis of distributors
10. DC and AC Distributions; Interconnected. Systems
11. Substation; types of substations, bus bar arrangements
12. Grounding and Earthing
13. Underground Cables

Recommended Texts

1. Grainger, and Stevenson. (1994). *Power System Analysis*. UK: Mc Graw Hill Education.
2. V. K. Mehta. (1999). *Principles of Power Systems*. Revised. Edition. Delhi India: S.Chand & Co Ltd.

Suggested Readings

1. Turen Gonen. (2009). *Electrical Power Transmission System Engineering—Analysis & Design*. (2nd ed.). Boca Raton: Taylor & Francis.
2. Subir Ray. (2014). *Electrical Power System; Theory, Concepts, Practice* (2nd ed.). India: PHI Learning.

ET-223 Electrical Power Transmission (Lab) 1 (3 + 1)

The purpose of this lab workout is to develop a practical understanding of the Electrical Power Transmission System that holds a position of backbone in Electrical Network. Experiments are performed. on Transmission trainer that represents Short, Medium and Long transmission line models. Transmission line parameters including Line Resistance, Line Conductance and Line Capacitance are measured. At the same time experiments are performed. to calculate voltage regulation of different lengths of transmission lines.

Contents

1. (a). Familiarization with Energy Analyzer
   (b). Introduction to the transmission line trainer
2. Familiarization and calculation of transmission line parameters
3. To understand the construction, characteristics and applications of different types of insulators.
4. To analyze the effect of Resistance on the transmission line Experiment no.
5. To Analyze the effect of inductance on the transmission line
6. To Analyze the effect of capacitance on the transmission line
7. To Calculate the flow of active and reactive power in 3-Phase transmission line at known load
8. To Calculate Voltage regulation of transmission line as a function of the type of Load
9. To understand the construction and technical specifications of different types of OHL conductors
10. To understand main supporting units of OHTL (Transmission Towers)
11. To understand the construction, characteristics, selection and application of Lightning arrestors
12. To Analyze the connection of transmission line with 3 phase feeder
13. To understand vibration damper and its types used. in transmission line
14. To learn about different types of underground cables

Recommended Texts

1. Grainger, and Stevenson. (1994). *Power system analysis*. UK: Mc Graw Hill Education.
2. V. K. Mehta. (1999). *Principles of power systems*. Delhi India: S.Chand and Co Ltd.

Suggested Readings

3. Turen Gonen. (2009). *Electrical power transmission system engineering—analysis & design*. (2nd Ed.). Boca Raton: Taylor & Francis.
4. Subir Ray. (2014). *Electrical power system; theory, concepts, practice*. (2nd Ed.) India: PHI Learning.

ET-224 **Data and Computer Communication** **4 (3+1)**

Data and Computer Communication is an introductory course in computer communications and networking to enable students to develop necessary data communication and networking skills. It familiarizes the students with the basics of data communications, OSI model, techniques, applications and control of modern data and computer communication networks. This course will mainly focus on developing technical skills in troubleshooting and designing data networks and serves as a general introduction for students seeking to acquire a foundation in current network technologies for local area networks (LANs), wide area networks (WANs) and the Internet. The aim is to provide an introduction to hardware, software, terminology, components, design, and connections of a network. Network concepts such as the OSI model, topologies, and major protocols, as well as the basic functions of system administration and operation are also included. Finally, concepts of inter- networking, fragmentation and reassembly, subnetting, routing and forwarding are also the part of this course.

Contents

1. Introduction to computer networks
2. Protocol Architecture: three-layer model and OSI model
3. Network topologies
4. Data transmission
5. Physical layer Transmission media
6. Data encoding techniques
7. Digital data communication techniques
8. Data communication interfaces
9. Data link layer and its protocols
10. Local Area Networks (LAN) and Wide Area Networks (WAN)
11. Multiplexing: time division and frequency division
12. Routing/Forwarding: routing tables, distance vector
13. Inter-networking: fragmentation and reassembly
14. Spread spectrum: direct sequence, frequency hopping
15. Internet protocol (IP) and subnetting
16. Circuit switching and packet switching
17. World Wide web

Recommended Texts

1. Stallings, W. (2013). *Data and computer communication* (10thed.). United. Kingdom: Pearson.
2. Peterson, L.,& Davie, B.(2011). *Computer Networks: A Systems Approach.* (5thed.). United. States: Morgan Kaufmann.

Suggested Readings

1. Forouzan, B. A. (2012). *Data communications and networking* (5thed.). New York: McGraw-Hill International.
2. Irvine, J.,& Harle, D. (2001). *Data communications and networks: An engineering approach.* (1sted.). New York: Wiley.

ET-224 **Data and Computer Communication (Lab)** **1 (0+1)**

The aim of this course is to develop an understanding of the various aspects of data communications and computer networking. The students will be able to develop through understanding of necessary computer communication and networking skills.

Contents

1. Cables and Connectors in Computer Networking.
2. Introduction to networking devices.
3. Understanding of Internet Protocol (IPv4).
4. Verify and test network connectivity.
5. VLAN configuration.
6. Configure trunking and native VLAN for trunking ports.
7. Concept of routing and basic router operating commands.
8. Configuring 802.1Q trunk-based. inter-VLAN routing.
9. IPv4 Subnetting
10. Overview of Wide Area Networks.
11. Enabling file and printer sharing in Windows environments.
12. Understanding web hosting processes.
13. Introduction to Adhoc networks.

Recommended Texts

1. Course Lab Manual.
2. Stallings, W. (2008). *Data and computer communications* (8th ed.). New Jersey USA: Pearson Ed.ucation.
3. Kaufmann, M.(2011). *Computer Networks A Systems Approach* (5th ed.). MA USA: Elsevier.

Suggested Readings

1. Lammle, T. (2011). *CCNA Cisco Certified Network Associate Deluxe Study Guide*. New Jersey USA: John Wiley & Sons.

MS-225 **Total Quality Management** **2 (2+0)**

The aim of this course is to enable students to develop quality management skills and ISO (International Standards Organization) standards. The aim of this course is to introduce the main ideology of industry, business, and organizations to generate knowled.ge and skills of students to use models (PAF Model) and quality management methodology (ISO-9001QMS) for the implementation of total quality management in any domain of business. This course is to provide an understanding of quality management (Quality Control, Quality Assurance, Quality Management & Continuous Quality Improvement). Students will learn how organizations can develop excellence through the adoption of continuous improvement (CQI). The course analyzes and uses various process management techniques, continuous improvement tools, and strategies to improve quality. This course enables students to provide leadership in shaping culture for quality within an organization. Total Quality Management is an ideology, methodology, and system of basic & advanced. tools intended. to create and maintain a procedure (Standard Operating Procedure) of the organization's continuous improvement.

Contents

1. Introduction to Quality: Quality concepts, types, and aspects
2. Significance of quality.
3. Commitment and Policy, Creating or changing the culture
4. Effective Leadership.
5. Quality Planning: Flowcharting, process charting,
6. Purchase planning, planning for JIT (Just in Time).
7. Design for Quality: Innovation
8. Quality Function Deployment and the house of Quality.
9. Quality-Related. Costs: Prevention, Appraisal, and Failure Costs
10. Models for quality Costing (PAF Model)
11. Quality Measurement: Significance, Methods, Tools, and Techniques
12. Quality Improvement: Basic Tools, Advanced. Tools.
13. Quality Management System (ISO 9000 series): Significance, Documentations,
14. Implementation and Certification, Audits, Expected. Problems.
15. Environmental Management System (ISO 14000 series): Significance, Documentations,
16. Implementation and Certification, Audits, Expected. Problems.

Recommended Texts

1. Oakland J. S. (*2014). Total quality management (4th ed.).* Oxford: Butterworth Heinemann Ltd. UK.

Suggested Readings

1. Feigenbaum. (1991). *Total quality control*. New York: McGraw-Hill International.
2. Gillow H. S. and Gillow S. J. (1994). *Total quality management in action*. New Jersey: Prentice Hall USA.

ET-311 **Microprocessor Theory and Interfacing** **4(3+1)**

The aim of this course is to familiarize the students with the internal architecture, Assembly Language programming concepts and I/O interfaces of 8086 & 8088 microprocessors. Students will develop in-depth understanding of the Intel x86 software programming model and instruction set. Course will focus on Intel x86 assembly programming techniques. Students will also learn 8086/8088 modes of operations, interfacing of memory and I/O devices hierarchy. Also, the memory mapping, address decoding and Digital to analog and Analog to Digital Conversion is studied. in detail.

Contents

1. Computer Organization & Architecture.
2. Number Systems Review.
3. 8086/8088 internal Micro-architecture.
4. Programming Model of 8086/8088 Microprocessors.
5. Segment Registers, Data Registers & Status Register.
6. Memory Address Space & Stack.
7. High Level vs. Low Level Programming Paradigm.
8. 8086/8088 Addressing Modes.
9. Data Transfer Instructions.
10. Arithmetic, Logical & Shift Instructions.
11. Control Flow & Jump Instructions.
12. Interfacing concepts.
13. Interfacing of Microprocessors with RAM & ROM.
14. Basic of I/O Interfacing with I/O ports(serial and parallel).
15. Memory Map and Address Decoding, D/A & A/D.

Recommended Texts

1. Daglas V. Hall. (1992). *Microprocessor and interfacing* (3rd ed.). United. Kingdom: Gregg Community College Div.
2. Berry B. Bari. (2008). *Intel Microprocessors*. USA: Pearson

Suggested Readings

1. N. Senthil Kumar. (2011). *Microprocessors and microcontrollers*. UK: Oxford University Press

ET-311 **Microprocessor Theory and Interfacing** **4 (3+1)**

Microprocessor Theory and Interfacing course introduces students to small microprocessor based. systems, with an emphasis on embedded system hardware and software design. This course fully utilizes the knowled.ge learned. in the fundamentals of digital logic design, computer architecture and programming languages. First portion of this course introduces the basics of microprocessor and microcontroller along with the architectures of 8-bit and 16-bit microprocessors. Students will learn the architectural issues of simple 1-bit microprocessor concluding to 8086(16-bit) microprocessor architecture. Second portion of the course emphasizes on interfacing the memory and I/O devices with 8086 microprocessors. Students will be able to design the decoding circuitry for interfacing memory and basic I/O devices with microprocessors. Further, assembly language programming will be covered. in this portion. Finally, apply the concepts to design microprocessor-controlled. systems including closed. loop control systems, temperature monitoring and control system, washing machine controller, diesel generator set controller and stepper motor controller.

Contents

1. Basic computer structure and simple 1-bit microprocessor
2. 8-bit Microprocessor (8085): pins, features and architecture
3. Instruction set and timing diagrams of 8085 microprocessor
4. 16-bit Microprocessor (8086): pins, features and architecture
5. Addressing modes and Interrupts of 8086 microprocessor
6. Interfacing memory devices with 8085 microprocessors
7. Memory organization of 9086 microprocessor
8. Interfacing memory devices with 8086 microprocessors: Address decoding techniques
9. I/O Interfacing (8086): I/O devices and controllers, I/O modes in Computer System
10. Assembly Language Programming (8086): syntax, rules of assembly languages
11. Assembly Language Programming (8086): variable declaration and assembler directives
12. Instruction Types: arithmetic, data, logical and program control instructions
13. Assembly language programs of data transfer and logical instructions
14. Assembly language programs of arithmetic and program control instructions
15. Microprocessor controlled. systems: temperature monitoring and control system
16. Washing machine controller, diesel generator set controller and stepper motor controller.

Recommended Texts

1. Hall, D. V. (2012). *Microprocessor and interfacing* (3rd ed.). New York: McGraw-Hill International.
2. Gilmore, C. (1995). *Microprocessors: principles and application* (3rd ed.). New York: McGraw-Hill International.

Suggested Readings

1. Antonakos, J. L. (1999). *An Introduction to the Intel Family of Microprocessors* (3rd ed.). NJ: Prentice Hall.
2. Brey, B. B. (2006). *The Intel Microprocessors, Pentium, and Pentium Pro Processor Architecture, Programming, and Interfacin* (8th ed.). NJ: Prentice Hall.

ET-311 Microprocessor Theory and Interfacing (LAB) 1(3+1)

Microprocessor Theory and Interfacing lab work introduces students to small microprocessor-based. systems, with an emphasis on embedded. system hardware and software design. In this lab students learn the basics of simulation and implementation of microprocessor systems. The simulation part of this lab is related. to proteus and Arduino co-simulation. The implementation part includes the use of the Arduino platform.

Contents

1. Introduction to the Proteus.
2. Simulation of ALU using proteus
3. Introduction to the Arduino UNO.
4. Introduction to LDR sensor as an input using Proteus and Arduino
5. Introduction to IR sensor using Proteus and Arduino.
6. Introduction to Stepper Motor using Proteus and Arduino UNO.
7. Interfacing of Seven-Segment display with Arduino UNO.
8. LED. control with LDR and Arduino UNO.
9. Interfacing of IR Sensor with Arduino UNO to detect presence of an object.
10. Analog Read Serial with Arduino UNO *Recommended Texts*

1. Hall, D. V. (2012). *Microprocessor and Interfacing* (3rd ed.). USA: Tata McGraw-Hill.

Suggested Readings

1. Antonakos, J. L. (1999). *An Introduction to the Intel Family of Microprocessors* (3rd ed.). UK: Prentice Hall.

ET-312 **Power and Industrial Electronics** **4 (3+1)**

The subject starts with coverage of the full spectrum of modern power semiconductor devices, their characteristics, both static and switching. Modern power semiconductor devices e.g., diodes, thyristors, MOSFETS, and other insulated. gate devices such as the IGBT, MCT and the FCT; Static and switching characteristics, gate drive and protection techniques; their drive circuit design and protection techniques including the snubber. Various topologies of power converter circuits are then treated., together with analysis of their operation, control characteristics, efficiency and other operational features. These include major areas of applications in AC-DC, DC-DC, and DC-AC power converter circuits. Analyses of input and output waveforms of these circuits so as to obtain their harmonic performance are also undertaken. A basic understanding of devices, circuit principles and implications in input/output waveform quality is stressed. throughout the subject. Application considerations for remote and uninterruptible power supplies, and for computer systems, telecommunications, automobiles, traction and other industrial processes; Utility interaction, harmonic distortion, and power factor will also be included.

Contents

1. Introduction; Overview of power semiconductor devices, characteristics.
2. Diode (Uncontrolled.) rectifiers.
3. Introduction and working of PWM converters
4. Controlled. AC-DC rectifiers.
5. Non-Isolated. and isolated. DC - DC converters, Control issues.
6. DC - AC Converters (Inverters).
7. Isolated. converters.
8. Forward converters.
9. Flyback converters.
10. Gate drive and Snubber circuits.
11. switching mode power supplies
12. Device losses and thermal design.

Recommended Texts

1. M. H. Rashid, (2017). *Power electronics: circuits, devices and applications*. UK: Butter-Worth Heinemann.

Suggested Readings

1. C. W. Lander, (1981). *Power electronics*. USA: McGraw Hill.
2. Philip T. Krein, (1998). *Elements of power electronics*. UK: Oxford University Press

ET-312 **Power and Industrial Electronics (Lab)** **1 (3+1)**

Power and Industrial electronics has already found an important place in modern technology and has revolutionized. control of power and energy. This lab course is designed. to cover a wide range of topics that make up the field of power and Industrial electronics in a well-organized. manner. Power and industrial electronics lab course covering the characteristics of modern power semiconductor devices, which are used. as switches to perform the power conversions from ac-dc, dc-dc, dc-ac, and ac-ac, both the fundamental principles and in-depth study of the operation, analysis, and design of various power converters and examples of recent applications of power & Industrial electronics. This lab course discusses the application of mathematical and engineering tools for modeling, simulation and control oriented. for power and industrial electronics energy systems. For this purpose, explanatory material has been introduced. with MATLAB based. simulation models with the intention that students can benefit on the subject both from application and research points of view.

Contents

1. Study the characteristics of an SCR.
2. Study the characteristics of power transistors.
3. Single phase half wave-controlled. rectifier with resistive load.
4. Single phase full wave-controlled. rectifier with resistive load.
5. Single phase rectifier with inductive load.
6. Three- phase half-controller rectifier.
7. Three-phase full-controller rectifier.
8. Generation of a pulse width modulation waveform.
9. Study and understand the working of buck converter.
10. Study and understand the working of boost converter.
11. Study and understand the working of buck-boost converters.
12. Study of different types of relays.
13. Study of PLCs.

Recommended Texts

1. Rashid, M. H. (Ed.). (2017). *Power electronics handbook* (4th Ed.). UK: Butterworth-Heinemann.

Suggested Readings

1. Williams, B. W. (1987). *Power electronics: devices, drivers, and applications* (2nd Ed.). US: Macmillan International Higher Education.
2. Chute, G. M. (1956). *Electronics in industry* (3rd Ed.). US, McGraw-Hill Book Company.
3. M. Birmingham, K. Brown. (2015). *Programmable logic controllers* (4th Ed.). UK: Newnes.

ET-313 **Switchgear and Protective Devices** **4 (3+1)**

The main aim of this course is to study theory and the concept of switchgear and protective devices used. in electrical power systems. This course introduces basic concepts of the relationship of level of voltages and other physical parameters for electrical power system protection. This course also covers the effective and efficient protection and fault detection mechanism. This course will enable students to understand the basics of power protection equipment as well as analyzing the factors and parameters affecting efficient and reliable operation of electrical power systems.

Contents

1. Introduction; Switchgear and essential features of switchgear
2. Switchgear Equipment; Types of equipment used. in switchgear systems, locations of equipment
3. Bus-Bar Systems; Types, topologies of bus-bar arrangements
4. Faults; Types of faults in power system, short circuit currents, open circuit
5. Circuit Breakers; Principle of C.B, trc production and mitigation, types
6. Circuit Breakers; Oil circuit breakers, air-blast, SF_6 circuit breakers, vacuum circuit breakers
7. Control operation of circuit breaker; recovery voltage, re-striking voltage, re-striking voltage rate
8. Protective Relays; Purpose and function of relays, requirements of protective relaying
9. Types of relays; Electromagnetic attraction, induction, distance and impedance, and differential
10. Protection; Protection of alternators and transformers, protection of bus-bars, protection of transmission lines, protection against over voltage
11. Grounding and Earthing; Neutral grounding, system grounding, equipment grounding

Recommended Texts

1. V. K. Mehta. (2009). *Principles of power systems.* Delhi India: S.Chand and Co Ltd.

Suggested Readings

1. Turen Gonen. (2008). *Electrical power distribution systems* (2nd ed.). Boca Raton: Taylor & Francis.
2. Subir Ray. (2014). *Electrical Power System; Theory, Concepts, Practice*. (2nd ed.). India: PHI Learning.

ET-313 **Switchgear and Protective Devices (LAB)** **1 (3+1)**

The main aim of this lab work is to develop fundamental concepts of Switchgear and protective devices used. in electrical power systems. Experiments involve protective relays parameter calculations, commissioning and testing on basic level. Moreover, participants calculate error in protective relays and offsetting this error using setting dials. Protection and metering single line diagrams are to be explained. as well.

Contents

1. To Study Different Type of Switchgear Equipment in Power Systems
2. To Study various type of circuit breakers
3. Introduction to protection trainer
4. To analyze relay and its working
5. To analyze function of Over Voltage relay
6. To analyze function of Under Voltage relay
7. To analyze function of Phase Sequence relay
8. To analyze function of Under Frequency relay
9. To analyze function of Over Frequency relay
10. To analyze function of Phase Balance and Loss relay
11. To analyze function of Synchronoscope
12. To analyze function of Synchronous Check
13. To analyze function of Over/Under Current relay
14. To analyze function of Thermistor relay

Recommended Texts

1. V. K. Mehta. (1999). *Principles of power systems*. India: S.Chand publisher.

Suggested Readings

1. Turen Gonen. (2008). *Electrical power distribution systems*. New York: McGraw-Hill Education.
2. Subir Ray, (2014). *Electrical power system; theory, concepts, practice*. India: PHI Learning.

ET-314 **Telecommunication Technology** **3 (3+1)**

The aim of this course is to enable students to cover essential topics of Tele-communication systems. After completing the training, the students will be able to: Appreciate the early concepts of Telecommunications and how they are constantly being developed., understand how the Telecoms landscape has grown and transformed. dramatically over the years, acknowled.ge the various network types e.g. Wireline, Wireless and how they inter-operate, learn about the future of key modern Telecoms technologies. Construct an overview understanding of the complex global Telecommunications landscape.

Contents

1. Review of Fourier series transform and its properties.
2. Amplitude Modulation: Principle of amplitude modulation. AM transmitter and receiver.
3. Frequency Modulation: Principle of frequency modulation, FM transmitter and receiver
4. Aerial and wave propagation.
5. Time division multiplexing (TDM),
6. Frequency division multiplexing (FDM),
7. Comparison of FDM and TDM.
8. Digital modulation,
9. Types of digital modulations,
10. Effect of sampling and quantization of signals.
11. Digital transmission,
12. AWGN and Inter symbol interference,
13. Matched. filtering and pulse shaping.
14. Introduction to Satellite System,
15. Earth satellite station,
16. Orbit satellite station,
17. Mobile communication system: Concept of cellular phone, various types of mobile communication systems.
18. Optical fiber: Characteristics, types, sources and detectors

Recommended Texts

1. B.P. Lathi. (2010). *Modern digital and analog communication systems* (4^{th} ed.). Oxford: Oxford University Press.

2. Bruce Carlson, (2010). *Communication system*. USA: McGraw Hill Education.

3. V.G.A. Garg. (1999). *Principles and applications of GSM*. UK: Pearson, Prentice Hall.

ET-314 **Telecommunication Technology Lab** **1 (3+1)**

This lab aims to make students understand and implement essential concepts of Telecommunication systems; Modulation, Filtering, Sampling and Quantization, GSM structure, Fibre optics and splicing.

Contents

1. Generate signals of different frequency from signal generator and observe their superposition using oscilloscope
2. Implement lowpass and highpass filters to separate low frequency signals from high frequency
3. Perform Amplitude modulation and demodulation
4. Perform Frequency modulation and demodulation
5. Demonstrate the effects of sampling and quantization through ADC and DAC
6. Prepare a GSM mobile communication network structure
7. Visit a base transceiver station (BTS) site to familiarize with BTS equipment
8. Study optical fiber data sheets and determine signal losses in optical fiber
9. Splicing techniques for optical fiber

Recommended Texts

1. B.P. Lathi (2010). *Modern digital and analog communication systems* (4^{th} ed.). Oxford: Oxford University Press.

Suggested Readings

1. Bruce Carlson. (2010). *Communication system.* New York: McGraw Hill Education.

ET-315 **Industrial and Environmental Safety** **2 (2+0)**

The main aim of this course is the study of life-long learning to work safely following the rules and regulations and to implement effective hazard control tactics in accident prevention, safety management, occupational health, industrial hygiene, loss / risk control management, ergonomics. Understanding the classification of health hazards, sources of risk, classification of dangerous substances and their toxicity, routes of entry of toxic, environmental monitoring at the workplace, safety technology, and safety management techniques. Considering the health and safety policy, students become to detect, minimize, and eliminate hazards and risks associated. with labor practices, as well as to achieve occupational, industrial, and fire safety objectives. Furthermore, students become able to formulate or design a system, process, procedure, or program to meet desired. needs and then communicate effectively with a range of audiences.

Contents

1. Importance of Occupational Safety & Health, Classification of Health Hazards (Physical, Chemical & Biological)
2. Sources of risk: machinery, noise, electrical failure, indoor air,
3. Poor ventilation and lighting conditions, radiation, and ergonomics
4. Classification of dangerous substances and their toxicity
5. Routes of Entry (Skin, Eyes, Lungs & Stomach)
6. Occupational exposure limits
7. Environmental monitoring at the workplace, Measurement Techniques
8. Data Evaluation and Analysis
9. Safety Technology, Importance of safety practices, Basic concepts of plant safety
10. Safe machinery , Design and guarding , Mechanical handling, Manual handling
11. Access equipment, Transport safety, Chemical safety, Electricity and electrical equipment
12. Fire fighting techniques , Construction safety, Demolition
13. Personal Protective Equipment (PPE)
14. Safety Management Techniques, Accident prevention, Health and safety Policy
15. Safe systems of work, First Aid Provisions, Health and safety training,
16. Spill response protocols, Accident Investigation, Recording and Analysis
17. Communicating safety measures, Techniques of inspection, Health and safety regulations at workplace

Recommended Texts

1. Friend, Mark A., and James P. Kohn. (2018). *Fundamentals of occupational safety and health (4th ed.)*. Lanham: Rowman & Littlefield.

Suggested Readings

1. CIRIA Report 125 (1993). *A guide to the control of substances hazardous to health in design and construction*. London: Thomas Telford Publications UK.
2. F.A. Patty. (1994). *Industrial Hygiene and Toxicology Vol-I: General Principles* (4th ed.). New Jersey: Wiley

ET-321 **Power System Protection** **4 (3+1)**

The course presents different types of relays, relaying schemes, circuit breakers and fuses. Topics like discrimination and coordination are also introduced. The main objective of the course is to provide an overview of the principles and schemes for protecting power lines, transformers, buses. The course provides basic guidelines for relay protection and setting calculation. It also reviews power system faults and instrument transformers. Throughout the course, students will have an opportunity to be exposed. to the power system laboratory to learn more about different applications regarding power system protection. It will facilitate skills for calculating settings and testing of protection operation conditions. After completing this course the candidate shall understand the following items: Identify the challenges and solutions to industrial power system protection problems, select the appropriate protection schemes for various applications, gain knowled.ge about signal processing techniques needed. for power system protection, describe current and voltage transformers and their impact on protection scheme performance, identify, apply, and calculate settings for overcurrent, directional overcurrent, distance, differential and pilot protection schemes, identify and apply wide-area monitoring and control (and protection) schemes.

Contents

1. Introduction to protection system
2. Types of faults, effect of faults
3. Fuse as protective device, types and characteristics of fuses, selection and application of fuses
4. Discrimination and coordination, current transformer and its operation
5. Relay construction, basic relay terminology, electromagnetic relays
6. Thermal relays, static relays and introduction to microprocessor based. protective relays
7. Over current protection, distance protection, impedance relay, R-X diagram of impedance relay
8. Operation of impedance relay in different zones, reactance relay
9. Differential protection of transformers, generator protection, busbar protection
10. Arc voltage, arc interruption, re-striking voltage and recovery voltage
11. Resistance switching, current chopping circuit breaker, classification of circuit breakers
12. Oil circuit breakers, airblast circuit breakers, air break circuit breakers
13. SF6 circuit breakers, vacuum circuit breakers
14. Operational mechanism and rating of circuit breakers

Recommended Texts

1. S. Rao. (1983). *Switchgear and protection*. India: Khanna Publisher.
2. V. K. Mehta. (1999). *Principles of power systems*. India: S.Chand publisher

Suggested Readings

1. Paithanker & Bhide. (2013). *Fundamentals of power system protection*. UK: Prentice Hall.

ET-322 **Control Technology** **4 (3+1)**

Linear Control Systems is a core course offered. in Bachelor of Electrical Engineering Technology. In this course students are familiarized. with the time domain and frequency domain analysis of the linear systems. In frequency domain transfer function of the electromechanical system is obtained. and carried. out the calculations to determine its behavior theoretically. In time domain system transient and steady state behavior is considered. The steady state errors according to the system type for tracking the different signals are studied. in detail. Finding the system transfer function using block reduction technique for multiple subsystems and signal flow graph technique using Mason's Rule is discussed. Furthermore systems stability, effects of the pole zeros location on the system behavior is discussed. in detail. In the end system design techniques such as Root locus and Bode plot are used. to acquire the desired. response of the system. PI, PD and PID controllers are designed. and compare their responses for the better understanding of their effect on the system output.

Contents

1. Examples of Control System
2. Open-loop vs. Closed-loop Control
3. Properties of Closed-loop System
4. Mathematical modelling of electrical, mechanical and electromechanical systems
5. Linear approximation of physical systems
6. The transfer function and impulse response of LTI systems
7. Block diagrams, Signal flow graphs and Mason's gain formula
8. First order systems, Second order systems, Time domain specifications
9. Routh's Stability Criterion
10. Steady state error analysis, Steady state tracking and system types
11. Root-Locus plots, General rules for constructing root loci
12. Root-Locus analysis of control systems, Proportional (P) controller
13. Integral (I) controller, Derivative (D) controller, PI and PD controllers
14. PID controllers

Recommended Texts

1. Benjamin C. Kuo, (2009). *Automatic control systems* (10th ed.). New York: McGraw Hill Education
2. Norman S.Nise, (2011) *Control systems engineering* (6th ed.). New York: John Wiley & Sons Inc.

Suggested Readings

1. K. Ogata. (2010). *Modern control engineering* (5th ed.). New York: Pearson Inc

ET-322 **Control Technology Lab** **4 (3+1)**

A control system manages commands, directs, or regulates the behavior of the other devices or systems using control loops. It can range from a single home heating controller using a thermostat controlling a domestic boiler to large Industrial control systems which are used. for controlling processes or machines. System Analysis and Control manages and controls the overall Systems Engineering Process. This activity identifies the work to be performed. and develops the schedules and costs estimates for the effort.

Contents

1. MATLAB for Control Systems.
2. Transfer Functions in Matlab.
3. Simulink for Control Systems.
4. Differential Equation Modeling and Analysis of DC Motor Speed.
5. Magnetic Levitation system model and Analysis in SIMULINK.
6. Ball and Beam Modeling and Analysis.
7. Stability of a System.
8. To Measure Time-Domain Performance of the System.
9. Red.uction of Multiple Sub-Systems.
10. Steady State Error.
11. Root Locus.
12. Frequency Response Method.
13. PID controller design for DC Motor Speed.
14. PID controller design of Magnetic Levitation System.
15. PID controller design of Ball and Beam.

Recommended Texts

Use control technology lab manual.

ET-323 **High Voltage Technology** **4 (3+1)**

This course is intended. to provide a basic introduction to the theory of High voltage circuits linked. with operation and characteristics of the liquid, gaseous and solid materials. The students should be introduced. to high voltage generation, measurement, and transient and insulation breakdown. For the student this course represents the first contact with the diverse subject of high voltage engineering. It mainly aims at: I) introducing fundamental concepts and providing basic understanding within the area of classical experimental high voltage engineering; ii) familiarizing the student with the electric power system on a component level and iii) preparing the student for the second course High Voltage Technology which is essential for the student wishing to achieve a broader and deeper understanding of the subject. After successful completion of the two courses in high voltage engineering as a part of the electric power program, the student is well prepared. for a carrier e.g. as a R&D-engineer of high voltage design and laboratory activities or as a qualified. engineer dealing with various aspects of the components in the power system.

Contents

1. Importance of high voltage on all fields of daily life and medical application.
2. Dielectric Strength of solids, liquid and gases Breakdown of solids liquids and gases.
3. Breakdown of unstable states of matter, Role of high voltage in production of unstable states
4. Transformers, Series and cascaded. connections, Bracketing in Transformers and its purpose.
5. Series and Parallel Resonant Transformer, Tesla Coil, Transformer with Rectifier
6. Electrostatic Voltage Generators, Introduction of Impulse, Impulse Current Generators.
7. Standard Impulse used. for testing and working of MARX and Good-Let Generators.
8. Direct and Indirect Measurement of high Voltages and its significance.
9. Direct Measurement: HV probe, Potential Transformer, Ammeter in series with high resistance Voltage divider.
10. Spark gaps, Electrostatic and Electrodynamic Voltmeter, Hall Effect Sensor, Electro Optical Measurement
11. Basics and importance of grounding in low as well as High Voltage Devices and systems, Touch and step potential in HV lab.
12. Introduction to leakage current, its types and components, Method of measuring and minimizing leakage current.
13. Different types of polymeric and Ceramic.
14. Destructive, non-destructive, routine, fatigue, quantitative, qualitative, physical and chemical tests on different insulation materials, Health analysis of insulation.
15. Scope trends technologies and future of HVDC, Advantages and issues in HVDC systems.
16. HVDC distribution Systems and its applications.

Recommended Texts

1. Y. Kuffel, J. Kuffel and W. S. Zaingi, (1984). *High voltage engineering* (2nd ed.). UK: Butterworth-Heinemann.

Suggested Readings

1. M.S. Naidu, V. Kamaraju. (2004) *High voltage engineering* (4th ed.). Tata McGraw-Hill
2. M.Naeem Arbab,(2013) *High voltage engineering* (1st ed.). Peshawar: Afaq printers.
3. J. R. Lucas, (2001), *High voltage engineering* (1st ed.). Sri Lanka: Katson Books.

ET-323 **High Voltage Technology Lab** **1(3+1)**

The High Voltage Technology Laboratory is well-known in the various fields of engineering applications due to its significance. For an Electrical technologist, it is required. to gain a hand on experience of practical implementation of High Voltage Engineering. By this take, laboratory manuals based. on implementation, observations and analysis have been introduced. for the High Voltage Engineering Laboratory. At the end of course, students should be able to recognize the usage of control desks, testing transformer, safety precautions and analytical system tool, assemble and examine high voltage, impulse voltage generation and measurement of performance and express knowled.ge and analysis of disruptive discharge voltage.

Contents

1. Generation and measurement of AC voltage.
2. Generation and measurement of AC voltage through an oscilloscope.
3. Generation and measurement of AC voltage through sphere gaps.
4. Understand Generation and measurement of DC voltage.
5. Generation and measurement of DC voltage.
6. Voltage doubler circuit.
7. Polarity effect and insulation screen.
8. Generation and measurement of impulse voltage.
9. Generation and measurement of impulse voltage using trigger sphere gap.
10. Disruptive discharge voltage tests with alternating current.
11. Disruptive discharge voltage tests with direct current.
12. Lighting impulse disruptive discharge test.
13. Insulation test for transformer oil.

Recommended Texts

1. Y. Kuffel, J. Kuffel and W. S. Zaingi. (1984). *High voltage engineering* (2nd ed.). UK: Butterworth-Heinemann.

Suggested Readings

1. M.S. Naidu, V. Kamaraju. (2004), *High voltage engineering* (4th ed.). USA: Tata McGraw-Hill.
2. M.Naeem Arbab, (2013) *High voltage engineering* (1st ed.). Peshawar: Afaq printers.
3. J. R. Lucas. (2001). *High voltage engineering* (1st ed.). Sri Lanka: Katson Books.

ET-324 **Power Distribution & Utilization** **3 (2+1)**

The main aim of this course is to study theory and the concept of electrical power distribution and utilization. This course introduces basic concepts of relationship of level of voltages and other physical parameters for electrical power distribution. This course also covers the effective and efficient utilization of electrical energy. However, a large amount of power is lost due to inefficient utilization. This course will enable students to understand the basics of power distribution as well as analyzing the factors and parameters affecting efficient and reliable utilization of electrical power.

Contents

1. Introduction; Urban, Sub-Urban, Rural Distribution, Voltage Levels
2. Distribution System; Types of Distributors, Radial, Ring and Interconnected.
3. Distribution Transformers; Applications of Distribution Transformers
4. Variable Load; Estimation, Properties of Load, Voltage Regulations
5. Substation Systems; Switchgear Systems, Bus Bar arrangements
6. Power Factor; Causes of Low P.F, Improvement Methods
7. Grounding and Earthing; Neutral Grounding, Equipment Grounding, and System Grounding
8. Electrical Welding; Resistance Welding, Arc Welding
9. Electrical Heating; Dielectric Heating, Inductance Heating, Electric Furnaces, Microwave Heating
10. Electrochemical Processes; Electroplating, Electrolysis, Electro-Metallurgical process
11. Electrical Illumination; Laws, Units, Street Lighting, Traffic Lighting, Flood Lighting
12. Lamps and Bulbs; Types, Working and relative merits
13. Batteries; Types, Working and Charging of Batteries

Recommended Texts

1. V. K. Mehta. (1999). *Principles of power systems*. Delhi India: S.Chand and Co Ltd.
2. J. B. Gupta.(2009). *A course in electrical power*. India: S. K. Kataria and Sons.

Suggested Readings

1. Turen Gonen. (2008). *Electrical power distribution systems* (2nd ed.). Boca Raton: Taylor & Francis.
2. Subir Ray. (2014). *Electrical power system; theory, concepts, practice* (2nd ed.). India: PHI Learning.

PK.ST-325 **Pakistan Studies** **2(2+0)**

The course is designed. to acquaint the students of BS Programs with the rationale of the creation of Pakistan. The students would be apprised. of the emergence, growth and development of Muslim nationalism in South Asia and the struggle for freed.om, which eventually led. to the establishment of Pakistan. While highlighting the main objectives of national life, the course explains further the socio-economic, political and cultural aspects of Pakistan's endeavors to develop and progress in the contemporary world. For this purpose, the foreign policy objectives and Pakistan's foreign relations with neighboring and other countries are also included. This curriculum has been developed. to help students analyze the socio-political problems of Pakistan while highlighting various phases of its history before and after the partition and to develop a vision in them to become knowledgeable citizens of their homeland.

Contents

1. Contextualizing Pakistan Studies
2. Geography of Pakistan: Geo-Strategic Importance of Pakistan
3. Freed.om Movement (1857-1947)
4. Pakistan Movement (1940-47)
5. Muslim Nationalism in South Asia
6. Two Nations Theory
7. Ideology of Pakistan
8. Initial Problems of Pakistan
9. Political and Constitutional Developments in Pakistan
10. Economy of Pakistan: Problems and Prospects
11. Society and Culture of Pakistan
12. Foreign Policy Objectives of Pakistan and Diplomatic Relations
13. Current and Contemporary Issues of Pakistan
14. Human Rights: Issues of Human Rights in Pakistan

Recommended Texts

1. Kazimi, M. R. (2007). *Pakistan studies*. Karachi: Oxford University Press.
2. Sheikh, J. A. (2004). *Pakistan's political economic and diplomatic dynamics.* Lahore: Kitabistan.

Suggested Readings

1. Hayat, S. (2016). *Aspects of Pakistan movement.* Islamabad: National Institute of Historical and Cultural Research.
2. Kazimi, M. R (2009). *A concise history of Pakistan.* Karachi: Oxford University Press.
3. Talbot, I. (1998). *Pakistan: A modern history*. London: Hurst and Company.

ET-421 **Supervised. Industrial Training** **16 (0+16)**

The student shall undergo supervised. Industrial Training (minimum duration of 16 Cred.it Hours). The objectives of the Industrial Training include: Assessing the needs of the industry in particular and global requirements in general. Shaping industrial links and introducing graduates that are compatible with industrial needs. To fulfill the requirement of the industry in the country by providing industrial solutions to the local industry with close collaboration and cooperation. The students are required. to submit a monthly Progress Report to the institute duly verified. by their Industrial supervisor. The institute is responsible to contact with all industrial supervisors to check the student's performance. At the end of the training, the students are required. to submit a detailed. report to the institute and undergo viva-voce examinations.

ET-421 Supervised. Industrial Training 16 (0+16)

The student shall undergo supervised. Industrial Training (minimum duration of 16 Cred.it Hours). The objectives of the Industrial Training include: Assessing the needs of the industry in particular and global requirements in general. Shaping industrial links and introducing graduates that are compatible with industrial needs. To fulfill the requirement of the industry in the country by providing industrial solutions to the local industry with close collaboration and cooperation. The students are required. to submit a monthly Progress Report to the institute duly verified. by their Industrial supervisor. The institute is responsible to contact with all industrial supervisors to check the student's performance. At the end of the training, the students are required. to submit a detailed. report to the institute and undergo viva-voce examinations.