COURSE
OUTLINE BRIEFS

SARGODHA UNIVERSITY
Pathway to Progress

FACULTY OF
ENGINEERING
& TECHNOLOGY

Academic Programs Offered.

1. BSc Mechanical Engineering
2. MSc Mechanical Engineering

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, (6^{th} 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

1 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, 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.

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*, (6^{th} ed.). NJ: wiley & sons.

Suggested Readings

1. Douglas C. Montgomery and George C. Runger, (2008) *Applied. Statistics and Probability for Engineers*, (6^{th} 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) (4th 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* (10^{th} 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