PAAVAI ENGINEERING COLLEGE, NAMAKKAL – 637 018

(AUTONOMOUS)

B.E. MECHANICAL ENGINEERING

REGULATIONS 2015

CURRICULUM

SEMESTER – III

Course Code	Course Title	L	T	P	C
MA15301	Transforms and Boundary Value Problems	3	2	0	4
ME15301	Engineering Thermodynamics	3	2	0	4
ME15302	Manufacturing Technology-I	3	0	0	3
ME15303	Engineering Materials and Metallurgy	3	0	0	3
ME15304	Fluid Mechanics and Machinery	3	0	0	3
EE15305	Electrical Machines and Drives	3	0	0	3
ME15305	Manufacturing Technology Laboratory -I	0	0	4	2
ME15306	Fluid Mechanics and Machinery Laboratory	0	0	4	2
EE15306	Electrical Engineering Laboratory	0	0	4	2

SEMESTER – IV

Course Code	Course Title	L	T	P	C
MA15404	Numerical Methods	3	0	0	3
ME15401	Thermal Engineering	3	0	0	3
ME15402	Kinematics of Machinery	3	0	0	3
ME15403	Manufacturing Technology-II	3	0	0	3
ME15404	Strength of Materials	3	2	0	4
CH15403	Environmental Science and Engineering	3	0	0	3
ME15406	Thermal Laboratory	0	0	4	2
ME15407	Manufacturing Technology Laboratory II	0	0	4	2
ME15408	Strength of Materials Laboratory	0	0	4	2
EN15401	Business English Course Laboratory	0	0	2	1

MA 1530 TRANSFORMS AND BOUNDARY VALUE PROBLEMS 3 2 0 4

COURSE OBJECTIVES

- To introduce Fourier series analysis which are common for many engineering applications apart from solving boundary value problems.
- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes
- To develop Z transform techniques for discrete time systems.

UNIT I FOURIER SERIES 15

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Gibb's Phenomenon – Complex form of Fourier Series – Parseval's identity – Harmonic Analysis.

UNIT II FOURIER TRANSFORMS 15

Fourier integral theorem (without proof) – Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT III PARTIAL DIFFERENTIAL EQUATIONS 15

Formation of partial differential equations – Lagrange's linear equation – Solutions of standard types of first order partial differential equations - Linear partial differential equations of second and higher order with constant coefficients.

UNIT IV APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 15

Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two-dimensional equation of heat conduction.

UNIT V Z - TRANSFORMS AND DIFFERENCE EQUATIONS 15

Z-transforms – Elementary properties – Inverse Z-transform – Convolution theorem – Formation of difference equations – Solution of difference equations using Z-transform.

TOTAL: 75 PERIODS

COURSE OUTCOMES

At the end of the course, the students would

- have gained a well founded knowledge of Fourier series, their different possible forms and the frequently needed practical harmonic analysis that an engineer may have to make from discrete data.

- have grasped the concept of expression of a function, under certain conditions, as a double integral leading to identification of transform pair and specialization on Fourier transform pair, their properties.
- have obtained capacity to formulate and identify certain boundary value problems encountered in engineering practices, decide on applicability of the Fourier series method of solution, solve them and interpret the results.
- be capable of mathematically formulating certain practical problems in terms of partial differential equations, solve them and physically interpret the results.
- have learnt the basics of Z – transform in its applicability to discretely varying functions, gained the skill to formulate certain problems in terms of difference equations and solve them using the Z – transform technique bringing out the elegance of the procedure involved.

TEXT BOOKS

1. Veerarajan T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., New Delhi, Second reprint, 2012.
2. Narayanan S., Manickavasagam Pillai.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students" ,Vol. II & III, S.Viswanathan Publishers Pvt Ltd. 1998.

REFERENCES

1. Larry C. Andrews, Bhimsen K. Shivamoggi, "Integral Transforms for Enginears", SPIE Optical Engineering press, Washington USA (1999).
2. Ramana.B.V., "Higher Engineering Mathematics", Tata Mc-GrawHill Publishing Company limited, New Delhi (2010).
3. Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education (2007).
4. Erwin Kreyszig., "Advanced Engineering Mathematics" 10th edition, Wiley Publications.
5. Ray Wylie C and Barrett.L.C, "Advanced Engineering Mathematics", Tata McGraw Hill Education Pvt Ltd, Sixth Edition, New Delhi, 2012.

ME15301 ENGINEERING THERMODYNAMICS 3 2 0 4

COURSE OBJECTIVES

- To provide knowledge in the basic concepts, processes, first law and applications of thermodynamic system.
- To know about the second law, Carnot cycle and concept of entropy.
- To familiarize the properties of pure substance and steam power cycle.
- To understand the concepts of ideal and real gases and thermodynamics relations.
- To study the concepts of psychometric properties and processes.

UNIT I BASIC CONCEPT AND FIRST LAW 15

Basic concepts - concept of continuum, macroscopic approach, Thermodynamic systems - closed, open and isolated. Property, state, path and process, quasi-static process, work, modes of work, Zeroth law of thermodynamics – concept of temperature and heat. Concept of ideal and real gases. First law of thermodynamics – application to closed and open systems, internal energy, specific heat capacities, enthalpy, steady flow process with reference to various thermal equipments.

UNIT II SECOND LAW 15

Second law of thermodynamics – Kelvin's and Clausius statements of second law. Reversibility and irreversibility. Carnot theorem, Carnot cycle, reversed carnot cycle, efficiency, COP. Thermodynamic temperature scale, Clausius inequality, concept of entropy, entropy of ideal gas, principle of increase of entropy – availability.

UNIT III PROPERTIES OF PURE SUBSTANCE AND STEAM POWER CYCLE 15

Properties of pure substances – Thermodynamic properties of pure substances in solid,liquid and vapour phases, phase rule, P-V, P-T, T-V, T-S, H-S diagrams, PVT surfaces, thermodynamic properties of steam. Calculations of work done and heat transfer in nonflow and flow processes. Standard Rankine cycle, Reheat and regenerative cycle.

UNIT IV IDEAL AND REAL GASES AND THERMODYNAMIC RELATIONS 15

Gas mixtures – properties ideal and real gases, equation state, Avagadro's Law, Vander Waal's equation of state, compressability factor, compressability chart – Dalton's law of partial pressure, exact differentials, T-D relations, Maxwell's relations, ClausiusClapeyron equations, Joule –Thomson coefficient.

UNIT V PSYCHROMETRY 15

Psychrometry and psychrometric charts, property calculations of air vapour mixtures. Psychrometric process – Sensible heat exchange processes. Latent heat exchange processes. Adiabatic mixing, evaporative cooling.

TOTAL: 75 PERIODS

COURSE OUTCOMES

At the end of the course the students will be able to

- learn the basic concept ,first law, concept of ideal and real gases.
- understand the real time applications of Carnot theorem, COP, Clausius inequality and availability.
- enhance the knowledge on properties of pure substances and steam power cycle.
- know the real time applications of ideal ,real gases and thermodynamic relations.
- understand the applications of psychrometry.

TEXT BOOKS

1. Nag.P.K., "Engineering Thermodynamics", Tata McGraw-Hill,New Delhi, 1998.
2. Cengel, 'Thermodynamics – An Engineering Approach' Third Edition – 2003 – Tata McGraw Hill, New Delhi.

REFERENCES

1. Holman.J.P., "Thermodynamics", 3rd Ed. McGraw-Hill, 1995.
2. Venwylen and Sontag, "Classical Thermodynamics", Wiley Eastern, 1987
3. Arora C.P, "Thermodynamics", Tata McGraw-Hill, New Delhi, 2003.
4. Rathakrishnan.E, "Fundamentals of Engineering Thermodynamics"Second Edition, PHI Learning Pvt. Ltd,2005
5. Achuthan.M "Engineering Thermodynamics" PHI Learning Private Limited,New Delhi ,2009

WEB LINKS

1. home.iitk.ac.in/~suller/lectures.htm
2. http://personal.cityu.edu.hk/~bsapplec/psychrom.htm

ME15302 MANUFACTURING TECHNOLOGY I 3 0 0 3

COURSE OBJECTIVES

- To familiarize the concepts of basic manufacturing processes, metal casting processes and melting furnaces.
- To learn the working principles of arc welding, gas welding and special welding processes.
- To provide knowledge in manufacturing processes, hot and cold working processes with their typical applications.
- To understand the sheet metal characteristics, operations, and special forming processes.
- To get exposure to various types of plastic injection molding processes and typical applications.

UNIT I METAL CASTING PROCESSES 9

Sand casting – Sand moulds - Type of patterns – Pattern materials – Pattern allowances – Types of Moulding sand – Properties – Core making – Methods of Sand testing – Moulding machines – Types of moulding machines - Melting furnaces –Working principle of Special casting processes – Shell, investment casting – Ceramic mould – Lost Wax process – Pressure die casting – Centrifugal casting – CO2 process – Sand Casting defects – Casting cleaning process - Inspection methods

UNIT II JOINING PROCESSES 9

Fusion welding processes – Types of Gas welding – Equipments used – Flame characteristics – Filler and Flux materials - Arc welding equipments - Electrodes – Coating and specifications – Principles of Resistance welding – Spot/butt, seam welding – Percusion welding - Gas metal arc welding – Flux cored – Submerged arc welding – Electro slag welding – TIG welding – Principle and application of special welding processes - Plasma arc welding – Thermit welding – Electron beam welding – Friction welding – Diffusion welding – Weld defects – Brazing and soldering process – Methods and process capabilities – Filler materials and fluxes – Types of Adhesive bonding.

UNIT III BULK DEFORMATION PROCESSES 9

Hot working and cold working of metals – Forging processes – Open, impression and closed die forging – Characteristics of the process – Types of Forging Machines – Typical forging operations – Rolling of metals – Types of Rolling mills - Flat strip rolling – Shape rolling operations – Defects in rolled parts - Principle of rod and wire drawing - Tube drawing – Principles of Extrusion – Types of Extrusion – Hot and Cold extrusion – Equipments used. Case Study: Manufacturing solid rocket-motor case segment for the space shuttle.

UNIT IV SHEET METAL PROCESSES 9

Sheet metal characteristics - Typical shearing operations, bending and drawing operations – Stretch forming operations – Formability of sheet metal – Test methods – Working principle and application of special

forming processes - Hydro forming – Rubber pad forming – Metal spinning – Introduction to Explosive forming, Magnetic pulse forming, Peen forming, Super plastic forming.

UNIT V MANUFACTURING OF PLASTIC COMPONENTS 9

Types of plastics - Characteristics of the forming and shaping processes – Moulding of Thermoplastics – Working principles and typical applications of - Injection moulding – Plunger and screw machines – Compression moulding, Transfer moulding – Typical industrial applications – Introduction to Blow moulding – Rotational moulding – Film blowing – Extrusion - Thermoforming, - Bonding of Thermoplastics.

TOTAL: 45 PERIODS

COURSE OUTCOMES

At the end of this course the students will be able to

- know about the types of casting and molding processes and melting furnaces.
- understand the various types of welding methods and their applications.
- analyze the various types of Forging processes ,types of rolling and extrusion processes.
- learn the various types of Sheet metal characteristics and Typical shearing operations.
- gain the knowledge on types of plastics and working of Injection Molding Machines.

TEXT BOOKS

1. Hajra Choudhury, "Elements of Workshop Technology, Vol. I and II", Media Promotors Pvt Ltd., Mumbai, 2001
2. S.Gowri, P.Hariharan, and A.SureshBabu, "Manufacturing Technology 1", Pearson Education , 2008.

REFERENCES

1. B.S. MagendranParashar & R.K. Mittal,"Elements of Manufacturing Processes", Prentice Hall of India, 2003.
2. P.N. Rao,"ManufacturingTechnology",Tata McGraw-Hill Publishing Limited, II Edition, 2002.
3. P.C. Sharma, "A text book of production technology",S. Chand and Company, IV Edition, 2003.
4. Begman, 'Manufacturing Process", John Wilely& Sons, VIII Edition, 2005.
5. SeropeKalpajian, Steven R.Schmid, Manufacturing Engineering and Technology, Pearson Education, Inc.2002 (Second Indian Reprint).

WEB LINKS

1. www.bookdepository.com
2. www.elsiver.com

ME15303 ENGINEERING MATERIALS AND METALLURGY 3 0 0 3

COURSE OBJECTIVES

- To learn about the micro-structure of materials, phase diagrams for different binary Alloys.
- To impart knowledge on different types of phase diagrams of alloys and types of heat treatments.
- To identify the various mechanical properties of materials through different types of tests and their significance.
- To know about different types of alloy steels with their applications, non-ferrous alloys with particular reference to copper, aluminum, magnesium, zinc, nickel, titanium, lead and tin alloys.
- To gain knowledge on the types, structure, properties and applications of polymers, ceramics and composites.

Review (Not for Exam)

Crystal structure – BCC, FCC and HCP structure – unit cell – crystallographic planes and directions, miller indices – crystal imperfections, point, line, planar and volume defects – Grain size, ASTM grain size number.

UNIT I CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS 9

Constitution of alloys – Solid solutions, substitutional and interstitial – phase diagrams,Isomorphous, eutectoid, eutectic, peritectic and peritectroid reactions, Iron – Iron carbide equilibrium diagram. Classification of steel and cast Iron, microstructure, properties and applications.

UNIT II HEAT TREATMENT 9

Definition – Full annealing, stress relief, recrystallisation and spheroidizing –normalising, hardening and tempering of steel. Isothermal transformation diagrams – cooling curves superimposed on I.T. diagram, CCR - Hardenability, Jominy end quench test – Austempering, martempering – case hardening - carburising, nitriding, cyaniding, carbonitriding, flame and induction hardening.

UNIT III MECHANICAL PROPERTIES AND TESTING 9

Mechanism of plastic deformation, slip and twinning – Types of fracture – Testing of materials under tension, compression and shear loads – Hardness tests (Brinell, Vickers and Rockwell), Impact test - Izod and Charpy, Fatigue and creep tests, fracture toughness tests.

UNIT IV FERROUS AND NON FERROUS METALS 9

Effect of alloying elements on steel (Mn, Si, Cr, Mo, V, Ti & W) - stainless and tool steels – HSLA - maraging steels – Cast Irons - Grey, White malleable, spheroidal – Graphite, Alloy cast irons, Copper and Copper alloys - Brass, Bronze and Cupronickel – Aluminum and Al-Cu alloy – precipitation hardening– Bearing alloys.

UNIT V NON-METALLIC MATERIALS 9

Polymers – types of polymer, commodity and engineering polymers – Properties and applications of PE, PP, PS, PVC, PMMA, PET, PC, PA, ABS, PI, PAI, PPO, PPS, PEEK, PTFE Polymers – Urea and Phenol Formaldehydes – Engineering Ceramics – Introduction to Fibre reinforced plastics.

TOTAL: 45 PERIODS

COURSE OUTCOMES

After completion of this course the students will be able to

- gain knowledge on micro-structure of materials, iron-carbon and other phase diagrams.
- acquire knowledge on isothermal transformation diagram and various types of heat treatments.
- know the concepts of plastic deformation, strengthening mechanisms and fracture of metals, various mechanical testing methods for properties and their engineering importance.
- understand different types alloy steels and their engineering applications, non-ferrous alloys with particular reference to copper, aluminium, magnesium, zinc, nickel, titanium, lead and tin alloys.
- learn the types, structure, properties and applications of polymers, composites materials.

TEXT BOOK

1. Kenneth G.Budinski and Michael K.Budinski "Engineering Materials" Prentice-Hall of India Private Limited, 4th Indian Reprint 2002.

REFERENCES

1. William D Callister "Material Science and Engineering", John Wiley and Sons 2007.
2. Raghavan.V "Materials Science and Engineering", Prentice Hall of India Pvt., Ltd., 2007.
3. Sydney H.Avner "Introduction to Physical Metallurgy" McGraw Hill Book Company, 2007.
4. Dieter G. E., Mechanical Metallurgy, McGraw Hill Book Company, 1988.
5. O.P. Khanna, A text book of Materials Science and Metallurgy, Khanna Publishers, 2003.

WEB LINKS

1. nptel.ac.in/courses/113106032/9%20-%20Phase%20diagrams.pdf
2. https://books.google.co.in/books?isbn=1856178099

ME15304 FLUID MECHANICS AND MACHINERY 3 0 0 3

COURSE OBJECTIVES

- To introduce the basic concepts of fluid mechanics for thorough understanding of the properties of fluids.
- To introduce the dynamics of fluids through the control volume approach.
- To understand the concepts of dimensionless parameters and its applications.
- To study the working principles of pumps and turbines, also their applications.
- To describe and learn the working of reciprocating and rotodynamic hydraulic machines

UNIT I INTRODUCTION 9

Units & Dimensions. Properties of fluids – Specific gravity, specific weight, viscosity, compressibility, vapour pressure and gas laws – capillarity and surface tension. Flow characteristics: concepts of system and control volume. Application of control volume to continuity equiation, energy equation, momentum equation and moment of momentum equation.

UNIT II FLOW THROUGH CIRCULAR CONDUITS 9

Laminar flow though circular conduits and circular annuli. Boundary layer concepts. Boundary layer thickness. Hydraulic and energy gradient. Darcy – Weisbachequaition. Friction factor and Moody diagram. Commercial pipes. Minor losses. Flow though pipes in series and in parallel.

UNIT III DIMENSIONAL ANALYSIS 9

Dimension and units: Buckingham's Π theorem. Discussion on dimensionless parameters. Models and similitude. Applications of dimensionless parameters.

UNIT IV ROTO DYNAMIC MACHINES 9

Homologus units. Specific speed. Elementary cascade theory. Theory of turbo machines. Euler's equation. Hydraulic efficiency. Velocity components at the entry and exit of the rotor. Velocity triangle for single stage radial flow and axial flow machines. Centrifugal pumps, turbines, performance curves for pumps and turbines.

UNIT V POSITIVE DISPLACEMENT MACHINES 9

Recriprocating pumps, Indicator diagrams, Work saved by air vessels. Rotary pumps. Classification. Working and performance curves.

TOTAL: 45 PERIODS

COURSE OUTCOMES

At the end of this course the student will be able to

- understand the fundamentals of fluid mechanics, including the basics of hydraulics, types of fluids-water, oils and its uses along with fluid properties.

- analyze fluid flow phenomena with the application of momentum and energy equation.
- perform dimensional analysis and to learn the several non-dimensional numbers with real time applications.
- acquire knowledge about the working principle of turbo machinery.
- learn the different types of pumps, fluid machineries and its working principles.

TEXT BOOKS

1. Streeter. V. L., and Wylie, E.B., Fluid Mechanics, McGraw Hill, 1983.
2. Rathakrishnan. E, Fluid Mechanics, Prentice Hall of India (II Ed.), 2007.

REFERENCES

1. Ramamritham. S, Fluid Mechanics, Hydraulics and Fluid Machines, DhanpatRai& Sons, Delhi, 1988.
2. Kumar. K.L., Engineering Fluid Mechanics (VII Ed.) Eurasia Publishing House (P) Ltd., New Delhi, 1995.
3. Bansal, R.K., Fluid Mechanics and Hydraulics Machines, Laxmi Publications (P) Ltd., New Delhi.
4. Grabel.W.P, Engineering Fluid Mechanics, Taylor Francis, Indian Reprint, 2011.
5. Modi P.N and Seth S.M, Hydraulics and Fluid Mechanics, Standard Book House, New Delhi 2004.

WEB LINK

1. www.mechanical.in/fluid-mechanics-and-machinery
2. http://nptel.ac.in/courses/105101082/1

EE15305 ELECTRICAL MACHINES AND DRIVES 3 0 0 3

(Common to Mechanical and Mechatronics)

COURSE OBJECTIVES

- To impart students with fundamentals of energy conversion, construction and principle of operation.
- To facilitate students to understand the characterization of electrical machines and various drives.
- To give awareness to concept of starting methods and speed control of electrical machines.
- To analyse the operation of solid state speed control of D.C. drives
- To understand the solid state speed control of A.C. drives

UNIT I DC MACHINES 9

DC Generator-Construction and Principle of operation, EMF Equation, types, OCC and External characteristics cures. DC Motors- Principle of operation, types, Characteristics – Starters - Braking methods.

UNIT II AC MACHINES 9

AC Generator-Construction and working principle - Three phase Induction motors, Construction, types, principle of operation, characteristics and starting methods, Single phase induction motor- Construction and working principle of operation.

UNIT III FUNDAMENTALS OF ELECTRIC DRIVES 9

Basic Elements – Types of Electric Drives – factors influencing the choice of electrical drives – heating and cooling curves – loading conditions and classes of duty – Selection of power rating for drive motors - Load variation factors.

UNIT IV CONVENTIONAL AND SOLID STATE CONTROL OF D.C. DRIVES 9

Speed control of DC series and shunt motors – Armature and field control, Ward- Leonard control system – Solid state control using controlled rectifiers (Single phase Half & Full wave) and DC choppers – applications.

UNIT V CONVENTIONAL AND SOLID STATE CONTROL OF A.C. DRIVES 9

Speed control of three phase induction motor – Voltage control, voltage / frequency control, slip power recovery scheme – Inverters and AC voltage regulators – applications.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On the completion of this course, the student will be able to

- select and utilize various types of D.C machines.
- employ effective control techniques to electrical motors.

- understand various elements involved in Electric drives.
- learn different solid state speed control methods of D.C. drives.
- select appropriate electrical drive for engineering applications.

TEXT BOOKS

1. Nagrath .I.J. & Kothari .D.P, "Electrical Machines", Tata McGraw-Hill, 2004.
2. Vedam Subrahmaniam, "Electric Drives (concepts and applications)", Tata McGraw- Hill, 2001.
3. Pillai S.K., "A First course on Electrical Drives", New Age International Publishers, 2011.

REFERENCES

1. Theraja B.L and Theraja A.K., "A Text book of Electrical Technology", Volume – II, S,Chand & Co., 2007.
2. M.D.Singh, K.B.Khanchandani, "Power Electronics", Tata McGraw-Hill, 1998
3. R.Krishnan, "Electric Motor Drives – Modeling, Analysis and Control", Prentice-Hall of India Pvt. Ltd., 2003.
4. Bimal K Bose, "Modern Power Electronics and AC Drives", Prentice-Hall of India Pvt. Ltd., 2003.
5. Muhammad H. Rashid, "Power Electronics: Circuits, Devices and Applications", Pearson Education, 2004.

WEBLINKS

1. https://en.wikipedia.org/wiki/DC_motor
2. https://en.wikipedia.org/wiki/AC_motor

ME15305 MANUFACTURING TECHNOLOGY LABORATORY I 0 0 4 2

COURSE OBJECTIVES

- To gain hands on experience on working of general purpose machine tools and various manufacturing processes.
- To acquire knowledge on Injection molding process and metal joining methods like Welding and Brazing.

Lathe

1.1. Facing, plain turning and step turning

1.2. Taper turning using compound rest, Tailstock set over, etc

1.3. Single start V thread (LH & RH), Knurling (Diamond & Single Start)

1.4. Internal thread cutting (Metric & BSW)

Welding exercises

2.1. Horizontal, Vertical and overhead welding.

2.2. Gas Cutting, Gas Welding

2.3. Brazing - for demonstration purpose

Sheet metal work

3.1. Fabrication of sheet metal tray

3.2. Fabrication of a funnel

Preparation of sand mould

4.1. Mould with solid, split patterns

4.2. Mould with loose-piece pattern

4.3. Mould with Core

Metal Casting – Demo

5.1 Cube (or) Gear Blank - for demonstration purpose

TOTAL: 60 PERIODS

COURSE OUTCOMES

At the end of the course students will be able to

- handle the Capstan or Turret Lathe and carry out various lathe operations.
- perform the metal joining welding operations such as lap-joint, butt joint and T-joint.
- make various sheet metal operations.
- understand about foundry technology and its applications.

ME15306 FLUID MECHANICS AND MACHINERY LABORATORY 0 0 4 2

COURSE OBJECTIVES

- To compute Coefficient of discharge of given Orifice meter.
- To calculate the rate of flow using Rota meter.
- To determine friction factor for a given set of pipes.
- To characterize reciprocating and gear pump.
- To test the performance of turbines.

LIST OF EXPERIMENTS

1. Determination of the Coefficient of discharge of given Orifice meter.
2. Determination of the Coefficient of discharge of given Venturi meter.
3. Calculation of the rate of flow using Rota meter.
4. Determination of friction factor for a given set of pipes.
5. Conducting experiments and drawing the characteristic curves of centrifugal pump/ submersible pump
6. Conducting experiments and drawing the characteristic curves of reciprocating pump.
7. Conducting experiments and drawing the characteristic curves of Gear pump.
8. Conducting experiments and drawing the characteristic curves of Pelton wheel.
9. Conducting experiments and drawing the characteristics curves of Francis turbine.
10. Conducting experiments and drawing the characteristic curves of Kaplan turbine.

TOTAL: 60 PERIODS

COURSE OUTCOMES

At the end of the course the students will be able to

- determine the Coefficient of discharge of given Orifice meter.
- analyze the rate of flow using Rota meter
- understand the friction factor for a given set of pipes.
- select an appropriate pump for a specific application.
- select a suitable type of turbine for the given situation

EE15306 ELECTRICAL ENGINEERING LABORATORY 0 0 4 2

COURSE OBJECTIVES

- To make the students conduct various experiments on D.C. machines and transformers and analyze their performance.
- To conduct the relevant experiments for determining the performance characteristics of AC machines.

LIST OF EXPERIMENTS

1. Load test on DC shunt motor and DC Series motor.
2. Open circuit characteristics and load characteristics of DC shunt.
3. Speed Control of DC Shunt Motor (Armature and Field control)
4. Load test on single phase transformer.
5. OC & SC test on single phase transformer.
6. Load test on three phase alternator.
7. Swinburne's test.
8. Load test on three phase squirrel cage induction motor.
9. Speed control of three phase squirrel cage induction motor.
10. Load test on single phase induction motor.
11. Study of DC and AC Starters.

TOTAL: 60 PERIODS

COURSE OUTCOMES

Upon the completion of the course, students will be able to

- summarize the characteristics of DC motors under loaded and unloaded conditions.
- implement the various starting methods in AC motors.
- implement the speed control in DC shunt motor.
- predict the performance characteristics of AC motors.

MA15404 NUMERICAL METHODS 3 0 0 3

(AERO, CIVIL, EEE, IT, MECH and MCT)

COURSE OBJECTIVES

- To analyze the solution for a large system of linear equations.
- To find the intermediate values when a series of data is given.
- To develop efficient algorithms for solving problems in science, engineering and technology.
- To solve the non-linear differential equations that cannot be solved by regular conventional method.
- To develop the accuracy of second order differential equation by finite difference method.

UNIT I SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS 9

Solution of equation –Iteration method : Newton Raphson method – Solution of linear system by Gaussian elimination and Gauss - Jordon method – Iterative method – Gauss-Seidel method – Inverse of a matrix by Gauss Jordon method – Eigenvalue of a matrix by power method.

UNIT II INTERPOLATION AND APPROXIMATION 9

Lagrangian Polynomials – Divided differences – Newton's Divided Difference, Hermite Interpolation Polynomial and Interpolating with a cubic spline – Newton‟s forward and backward difference formulas.

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION 9

Differentiation using interpolation formulae –Numerical integration by trapezoidal and Simpson's 1/3– Romberg's method – Two and Three point Gaussian quadratureformulas – Double integrals using trapezoidal and Simpsons' rule.

UNITIV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 9

Single step methods: Taylor series method – Modified Euler method for first order equation – Fourth order Runge – Kutta method for solving first and second order equations – Multistep methods: Milne's and Adam's predictor and corrector methods.

UNITV BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 9

Finite difference solution of second order ordinary differential equation – Finite difference solution of one dimensional heat equation by explicit and implicit methods – One dimensional wave equation and two dimensional Laplace and Poisson equations.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On the completion of the course, students will be able to

- understand the basics of problem solving in linear equations.

- learn the methods on interpolation which will be useful in constructing approximate polynomial to represent the data is understood.
- acquire basic knowledge in developing computer programs.
- apply the concepts of initial value problem with more accuracy in the field of science and engineering field.
- acquire the computational procedure of the amount of heat emitted or transferred from an object.

TEXTBOOKS

1. Erwin Kreyszig., "Advanced Engineering Mathematics" 10th edition, Wiley Publications, 2010.
2. T. Veerarajan, and T .Ramachandran, "Numerical Methods with programming in C", 2nd ed., Tata McGraw-Hill, 2006.
3. Sankar Rao K " Numerical Methods forScientisitsand Engineers –3rd Edition Princtice Hall of India Private, New Delhi, 2007.

REFERENCES

1. P. Kandasamy, K. Thilagavathy and K. Gunavathy, "Numerical Methods", S.Chand Co. Ltd., New Delhi, 2003.
2. Gerald C.F. and Wheatley, P.O., "Applied Numerical Analysis" 6th Edition, Pearson Education Asia, New Delhi, 2002.
3. M.K.Jain , S.R.K. Iyangar , R.K.Jain , "Numerical Methods For Scientific & Engineering Computation" , New Age International (P) Ltd , New Delhi , 2005.
4. M.B.K. Moorthy and P.Geetha, "Numerical Methods" , Tata McGraw Hill Publications company, New Delhi, 2011.
5. Saumyen Guha and Rajesh Srivastava, "Numerical methods for Engineering and Science", Oxford Higher Education, New Delhi, 2010.

WEB LINKS

1. https://www.youtube.com/watch?v=QTQ8bO1F-Dg
2. https://www.youtube.com/watch?v=AT7Olelic8U

ME15401 THERMAL ENGINEERING 3 0 0 3

COURSE OBJECTIVES

- To introduce the basic principles of thermodynamics via real-world engineering examples, to show students how thermodynamic is applied in engineering practice.
- To understand the fundamentals of operation of internal combustion engines, the factors affecting their performance, operation, fuel requirements and environmental impact.
- To provide knowledge about the analysis of various cycles used for power generation, combustion and kinetics involved in turbines.
- To acquire knowledge on design and working principles of compressors.
- To learn the methods of refrigeration and its types, psychrometry and its principles.

UNIT I GAS POWER CYCLES 9

Otto, Diesel, Dual, Brayton cycles, Calculation of mean effective pressure, and air standard efficiency - Actual and theoretical PV diagram of four stroke and two stroke engines

UNIT II INTERNAL COMBUSTION ENGINES 9

Classification - Components and their function. Valve timing diagram and port timing diagram - actual and theoretical p-V diagram of four stroke and two stroke engines. Governing of I.C. engines -Simple and complete Carburetor. MPFI, Diesel pump and injector system. Battery and Magneto Ignition System - Principles of Combustion and knocking in SI and CI Engines. Turbulence in S.I. engines - Lubrication and Cooling systems. Performance calculation.

UNIT III STEAM NOZZLES AND TURBINES 9

Flow of steam through nozzles, shapes of nozzles, effect of friction, critical pressure ratio, supersaturated flow, Impulse and Reaction principles, compounding, velocitydiagram for simple and multi-stage turbines, speed regulations –Governors.

UNIT IV AIR COMPRESSORS 9

Classification and working principle of various types of compressors, work of compression with and without clearance, Volumetric efficiency, Isothermal efficiency and Isentropic efficiency of reciprocating compressors, Multistage air compressor and inter cooling –work of multistage air compressor

UNIT V REFRIGERATION AND AIR CONDITIONING 9

Refrigerants classification, properties and applications - Vapour compression refrigeration cycle- super heat, sub cooling – Performance calculations - working principle of vapour absorption system, Ammonia –

Water, Lithium bromide –water systems (Description only). Air conditioning system - Processes, Types and Working Principles - Concept of RSHF, GSHF, ESHF- Cooling Load calculations.

TOTAL: 45 PERIODS

COURSE OUTCOMES

Upon completion of this course, the students will be able to

- analyze and apply the different gas power cycles for various requirements.
- know about the internal combustion engine components, operation and its performance.
- gain knowledge on the basic concepts of steam nozzles, turbines and their functions.
- learn the Performance characteristics of Air compressors.
- acquire knowledge about the various refrigeration techniques, psychrometric principles and cooling load calculations.

TEXT BOOKS

1. Sarkar, B.K,"Thermal Engineering" Tata McGraw-Hill Publishers, 2007
2. Kothandaraman.C.P., Domkundwar.S and Domkundwar. A.V., "A Course in Thermal Engineering," Dhanpat Rai & Sons , Fifth edition, 2002

REFERENCES

1. Rajput. R. K., "Thermal Engineering" S.ChandPublishers, 2000
2. Arora.C.P,"Refrigeration and Air Conditioning," Tata McGraw-Hill Publishers 1994
3. Ganesan V." Internal Combustion Engines", Third Edition, Tata Mcgraw-Hill 2007
4. Rudramoorthy, R, "Thermal Engineering ", Tata McGraw-Hill, New Delhi, 2003
5. R.S.Khurmi & J.K. Gupta "A Textbook Of Thermal Engineering" S. Chand, 2008

WEB LINKS

1. http://www.rejinpaul.com/2013/06/anna-university-me2301-thermal-engineering-notes-mech-5th-sem.html
2. www.iannauniversity.com/.../me2301-thermal-engineering-lecture.html

ME15402 KINEMATICS OF MACHINERY 3 0 0 3

COURSE OBJECTIVES

- To familiarize the concepts of machines, mechanisms and related terminology.
- To analyze the parameters of displacement, velocity and acceleration for planer mechanism graphically.
- To understand the importance of cam profiles for different types of motions.
- To describe the types of gear trains and its variation in speed through theoretical approach.
- To know the role of friction in belt drives and brakes.

UNIT I BASICS OF MECHANISMS 7

Definitions – Link, Kinematic pair, Kinematic chain, Mechanism, and Machine. –Degree of Freedom – Mobility - Kutzbach criterion (Gruebler's equation) -Grashoff'slawKinematic Inversions of four-bar chain and slider crank chain - Mechanical Advantage-Transmission angle. Description of common Mechanisms - Offset slider mechanism as quick return mechanisms, Pantograph, Straight line generators (Peaucellier and Watt mechanisms), Steering gear for automobile, Hooke's joint, Toggle mechanism, Ratchets and escapements - Indexing Mechanisms.

UNIT II KINEMATIC ANALYSIS 10

Analysis of simple mechanisms (Single slider crank mechanism and four bar mechanism) - Graphical Methods for displacement, velocity and acceleration; Shaping machine mechanism - Coincident points – Coriolis acceleration - Analytical method of analysis of slider crank mechanism and four bar mechanism. Approximate analytical expression for displacement, velocity and acceleration of piston of reciprocating engine mechanism**.**

UNIT III KINEMATICS OF CAMS 8

Classifications - Displacement diagrams - Parabolic, Simple harmonic and Cycloidal motions – Graphical construction of displacement diagrams and layout of plate cam profiles - circular arc and tangent cams - Pressure angle and undercutting.

UNIT IV GEARS 10

Classification of gears – Gear tooth terminology - Fundamental Law of toothed gearing and involute gearing – Length of path of contact and contact ratio - Interference and undercutting - Gear trains – Simple, compound and Epicyclic gear trains - Differentials.

UNIT V FRICTION 10

Dry friction – Friction in screw jack – Pivot and collar friction - Plate clutches - Belt and rope drives - Block brakes, band brakes. **TOTAL: 45 PERIODS**

COURSE OUTCOMES

At the end of this course, the student will be able to

- understand the types of motion, joints and degree of freedom.
- gain the knowledge on displacement, velocity and acceleration for planer mechanism graphically.
- design cam profile for different types of motions.
- choose a gear and gear train depending on the application.
- apply the friction concepts to belt drives and brakes.

TEXT BOOKS

1. Ambekar A. G., Mechanism and Machine Theory, Prentice Hall of India, New Delhi,2007
2. Uicker J.J.,Pennock G.R., Shigley J.E., "Theory of Machines and Mechanisms"(Indian Edition), Oxford University Press, 2003

REFERENCES

1. S.S.Rattan,"Theory of Machines", second edition, Tata Mc-Graw Hill, Delhi, 2008
2. P.L.Ballaney, "Theory of Machines: A textbook for Engg students", 15th edition, Khanna, Delhi, 1987
3. R.S.Khurmi&J.K.Gupta, "Theory of Machines", 14th Edition, Eurasia Publishing House, Delhi, 2005
4. V.Jayakumar, "Kinematics of Machinery", 1st Edition, Lakshmi Publisher, Chennai, 2004
5. Ghosh, A, and Malick, A. K., "Theory of Mechanisms and Machines" 3rd Edition, East West Press Pvt. Ltd., 2000.

WEB LINKS

1. ebooks.library.cornell.edu/k/kmoddl/pdf/016_002.pdf
2. https://www.vidyarthiplus.com/vp/Thread-ME2203-KINEMATICS-OF-MACHINERY-Lecture-Notes-adhithya-edition

ME15403 MANUFACTURING TECHNOLOGY II 3 0 0 3

COURSE OBJECTIVES

- To make the student to understand the basic principles of theory of metal cutting.
- To provide details of the construction of conventional lathe and metal cutting machine tools.
- To study the concept of Machine tools like shaping, slotting, planning, milling, drilling, grinding machines.
- To understand the manufacturing operations for gears and surface finishing processes.
- To study the CNC programming and part programming used for APT programming.

UNIT I THEORY OF METAL CUTTING 9

Introduction: Material removal processes, Types of machine tools – theory of metal cutting: chip formation, orthogonal cutting, cutting tool materials, tool wear, tool life, surface finish, cutting fluids.

UNIT II CENTRE LATHE AND SPECIAL PURPOSE LATHES 9

Centre lathe, constructional features, cutting tool geometry, various operations, taper turning methods, thread cutting methods, special attachments, machining time and power estimation. Capstan and turret lathes – automats – single spindle, Swiss type, automatic screw type, multi spindle - Turret Indexing mechanism, Bar feed mechanism**.**

UNIT III OTHER MACHINE TOOLS 9

Reciprocating machine tools: shaper, planer, slotter - Milling: types, milling cutters, operations - Holemaking: drilling - Quill mechanism, Reaming, Boring, Tapping -Sawing machine: hack saw, band saw, circular saw; broaching machines: broach construction – push, pull, surface and continuous broaching machines

UNIT IV ABRASIVE PROCESSES AND GEAR CUTTING 9

Abrasive processes: grinding wheel – specifications and selection, types of grinding process – cylindrical grinding, surface grinding, centreless grinding – Gear Finishing Process-honing, lapping, super finishing, polishing and buffing, abrasive jet machining - Gear cutting, forming, generation, shaping, hobbing.

UNIT V CNC MACHINE TOOLS AND PART PROGRAMMING 9

Numerical control (NC) machine tools – CNC: types, constructional details, special features – design considerations of CNC machines for improving machining accuracy –structural members – slide ways – linear bearings – ball screws – spindle drives and feed drives. Part programming fundamentals – manual programming – computer assisted part programming-APT Languages.

TOTAL: 45 PERIODS

COURSE OUTCOMES

At the end of the course, the student will be able to

- apply the concepts of theory of metal cutting in real life machining.
- gain the knowledge about the centre lathe, its accessories and relative operations which are performed in machine shop.
- know the basic concepts and working principles of other machines tools like Shaper, Drilling, Milling and all allied machines.
- apply the surface machining processes, design and fabrication of important machine elements.
- acquire knowledge on CNC machining, respective equipment and its parts along with the ability to develop CNC programs for machining of materials.

TEXT BOOKS

1. Hajra Choudry, "Elements of Work Shop Technology – Vol. II", Media Promoters. 2002
2. HMT – "Production Technology", Tata McGraw-Hill, 1998.

REFERENCES

1. Rao, P.N. "Manufacturing Technology", Metal Cutting and Machine Tools, Tata McGraw–Hill, New Delhi, 2003.
2. P.C. Sharma, "A Text Book of Production Engineering", S. Chand and Co. Ltd, IV edition, 1993.
3. Shrawat N.S. and Narang J.S, 'CNC Machines', DhanpatRai&Co., 2002.
4. P.N.Rao, 'CAD/CAM Principles and Applications', TATA Mc Craw Hill, 2007.
5. M.P.Groover and Zimers Jr., 'CAD/CAM' Prentice Hall of India Ltd., 2004.

WEBLINKS

1. http://www.notesengine.com/dept/mech/4sem/anna-university-4-sem-mech-notes.html.
2. https://www.youtube.com/playlist?list=PL2C105C94D2955C8B.

ME15404 STRENGTH OF MATERIALS 3 2 0 4

COURSE OBJECTIVES

- To familiarize the terminology like simple stresses, strains and deformation in components due to external loads.
- To understand the stresses and deformations through mathematical models of beams, twisting bars or combinations of both.
- To analyze torsion of circular bars and springs.
- To know about the deflection and slope of the beams and columns by using Euler equation.
- To learn about the stresses involved in two dimensional approach of thin cylindrical and spherical shells.

UNIT I STRESS STRAIN DEFORMATION OF SOLIDS 15

Rigid and Deformable bodies – Strength, Stiffness and Stability – Stresses; Tensile, Compressive and Shear – Deformation of simple and compound bars under axial load –Thermal stress – Elastic constants – Strain energy and unit strain energy – Strain energy in uniaxial loads.

UNIT II BEAMS - LOADS AND STRESSES 15

Types of beams: Supports and Loads – Shear force and Bending Moment in beams – Cantilever, Simply supported and over hanging beams – Stresses in beams – Theory of simple bending – Stress variation along the length and in the beam section – Effect of shape of beam section on stress induced – Shear stresses in beams – Shear flow.

UNIT III TORSION 15

Analysis of torsion of circular bars – Shear stress distribution – Bars of Solid and hollow circular section, Stepped shaft – Twist and torsion stiffness – Compound shafts – Fixed and simply supported shafts – Application to close-coiled helical springs – Maximum shear stress in spring section including Wahl Factor – Deflection of helical coil springs under axial loads – Design of helical coil springs – stresses in helical coil springs under torsion loads.

UNIT IV BEAM DEFLECTION 15

Elastic curve of Neutral axis of the beam under normal loads – Evaluation of beam deflection and slope: Double integration method, Macaulay Method, and Moment-area Method –Columns – End conditions – Equivalent length of a column – Euler equation – Slenderness ratio – Rankine formula for columns.

UNIT V ANALYSIS OF STRESSES IN TWO DIMENSIONS 15

Biaxial state of stresses – Thin cylindrical and spherical shells – Deformation in thin cylindrical and spherical shells – Biaxial stresses at a point – Stresses on inclined plane – Principal planes and stresses – Mohr's circle for biaxial stresses – Maximum shear stress - Strain energy in bending and torsion.

TOTAL: 75 PERIODS

COURSE OUTCOMES

At the end of the course the students will be able to

- apply the concepts of strength of materials to obtain solutions to real time Engineering problems.
- gain the mathematical knowledge to calculate the deformation behavior of simple structures.
- analyse critical problems related to mechanical elements and the deformation behavior for different types of loads.
- understand the torsion of circular bars and springs.
- analyze the deflection and slope of the beams and columns by using Euler equation.

TEXT BOOKS

1. Popov E.P, "Engineering Mechanics of Solids", Prentice-Hall of India, New Delhi,1997.
2. Beer F. P. and Johnston R," Mechanics of Materials", McGraw-Hill Book Co, Third Edition, 2002.

REFERENCES

1. Nash W.A, "Theory and problems in Strength of Materials", Schaum Outline Series, McGraw-Hill BookCo, New York, 1995
2. Kazimi S.M.A, "Solid Mechanics", Tata McGraw-Hill Publishing Co., New Delhi,1981.
3. Ryder G.H, "Strength of Materials, Macmillan India Ltd"., Third Edition, 2002
4. Ray Hulse, Keith Sherwin & Jack Cain, "Solid Mechanics", Palgrave ANE Books,2004.
5. Singh D.K "Mechanics of Solids" Pearson Education 2002.

WEB LINKS

- http://nptel.ac.in/courses/Webcourse-contents/IIT-ROORKEE/strength%20of%20materials /homepage.htm
- https://www.vidyarthiplus.com/vp/Thread-CE2252-STRENGTH-OF-MATERIALS-Lecture-notes-collections

CH15403 ENVIRONMENTAL SCIENCE AND ENGINEERING 3 0 0 3

COURSE OBJECTIVES

- To understand the constituents of the environment and the precious resources in the environment.
- To study all types of ecosystems and biodiversity.
- To familiarize the role of human being in maintaining a clean and green environment.
- To analyze social issues related to environment.
- To learn the role of population explosion, family welfare programme and value education.

UNIT I INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES 9

Environment: Definition- scope - importance – need for public awareness. Forest resources: Use –over exploitation- deforestation - case studies- mining - effects on forests and tribal people. Water resources: Use – over utilization of surface and ground water- floods – drought - conflicts over water. Mineral resources: Use – exploitation - environmental effects of extracting and using mineral resources - case studies. Food resources: World food problems - changes caused by agriculture and overgrazing - effects of modern agriculture- fertilizer-pesticide problems - water logging - salinity -case studies. Energy resources: Growing energy needs - renewable and non-renewable energy sources. Land resources: Land as resource - land degradation - soil erosion. Role of an individual in conservation of natural resources.

UNIT II ECOSYSTEMS AND BIODIVERSITY 9

Concept of an ecosystem: Structure and function of an ecosystem – producers - consumers -decomposers – energy flow in the ecosystem – ecological succession – food chains - food webs and ecological pyramids. Types of ecosystem: Introduction - characteristic features - forest ecosystem - grassland ecosystem - desert ecosystem - aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries). Biodiversity: Introduction– definition (genetic - species –ecosystem) diversity. Value of biodiversity: Consumptive use - productive use – social values – ethical values - aesthetic values. Biodiversity level: Global - national - local levels- India as a mega diversity nation- hotspots of biodiversity. Threats to biodiversity: Habitat loss - poaching of wildlife – man wildlife conflicts – endangered and endemic species of India. Conservation of biodiversity: In-situ and ex-situ conservation of biodiversity - field study.

UNIT III POLLUTION 9

Pollution: Definition –air pollution - water pollution - soil pollution - marine pollution - noise pollution - thermal pollution – nuclearhazards. Solid waste management: Causes - effects - control measures of urban and industrial wastes. Role of an individual in prevention of pollution - pollution case studies. Disaster management: Floods – earthquake - cyclone - landslides. Electronic waste-Sources-Causes and its effects.

UNIT IV SOCIAL ISSUES AND ENVIRONMENT 9

Sustainable development: Unsustainable to sustainable development – urban problems related to energy. Water conservation - rain water harvesting - watershed management. Resettlement and rehabilitation of people. Environmental ethics: Issues - possible solutions – climate change - global warming and its effects on flora and fauna - acid rain - ozone layer depletion - nuclear accidents - nuclear holocaust - wasteland reclamation - consumerism and waste products. Environment protection act: Air (Prevention and Control of Pollution) act – water (Prevention and control of Pollution) act – wildlife protection act – forest conservation act – issues involved in enforcement of environmental legislation.

UNIT V HUMAN POPULATION AND ENVIRONMENT 9

Human population: Population growth - variation among nations – population explosion – family welfare programme and family planning – environment and human health – Human rights – value education – HIV / AIDS, Swine flu – women and child welfare. Role of information technology in environment and human health.

TOTAL: 45 PERIODS

COURSE OUTCOMES

At the end of the course the student will be able to

- understand the basic concepts of environment studies and natural resources.
- gain knowledge about ecosystem and biodiversity.
- develop knowledge on causes, effects and control measures of various types of pollution.
- understand the social issues and various environmental acts.
- know the relationship between the human population and environment.

TEXT BOOKS

1. T.G.Jr. Miller, Environmental Science, 10thEdn, Wadsworth Publishing Co., (2004).
2. Raman Sivakumar, Introduction to Environmental Science and Engineering, 2ndEdn, Tata McGraw Hill Education Private Limited, New Delhi,(2010).
3. Benny Joseph, "Environmental Science and Engineering", Tata McGraw Hill, (2010).

REFERENCES

1. BharuchaErach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad India,2010.
2. S. Divan, Environmental Law and Policy in India, Oxford University Press, New Delhi, 2001.
3. K.D. Wager, Environmental Management, W.B. Saunders Co., Philadelphia, USA, 1998.
4. W.P. Cunningham, Environmental Encyclopedia, JaicoPublising House, Mumbai, 2004.
5. Clair Nathan Sawyer, Perry L. McCarty, Gene F. Parkin, "Chemistry for Environmental

WEB LINKS

1. www.chegg.com
2. www.vidhyarathiplus.com

ME15406 THERMAL LABORATORY 0 0 4 2

COURSE OBJECTIVES

- To apply the thermodynamic concepts into various thermal applications like IC engines, steam Generator, turbine and other thermal devices.
- To study valve timing diagram and performance of IC Engines
- To learn the characteristics of fuels/Lubricates used in IC Engines
- To analyze the Performance of steam generator/ turbine

LIST OF EXPERIMENTS

I.C Engine lab and Fuels lab 30

- Valve Timing and Port Timing Diagrams.
- Performance Test on 4-stroke Diesel Engine/Petrol Engine
- Heat Balance Test on 4-stroke Diesel Engine.
- Morse Test on Multi cylinder Petrol Engine.
- Retardation Test to find Frictional Power of a Diesel Engine.
- Determination of Viscosity – Red Wood Viscometer.
- Determination of Flash Point and Fire Point.

STEAM LAB 30

- Study of Steam Generators and Turbines.
- Performance and Energy Balance Test on a Steam Generator.
- Performance and Energy Balance Test on Steam Turbine.

TOTAL: 60 PERIODS

COURSE OUTCOMES

At the end of the course the students will be able to

- learn the valve and port timing diagrams involved in the operation of engines
- evaluate the performance of an IC engine
- acquire knowledge in determining the viscosity of oils
- find out the flash and fire point of fuels
- analyze the performance of steam generator/ turbine

WEB LINKS

- http://web.csulb.edu/colleges/coe/mae/views/courses/upper/upper_337.shtml
- http://ocw.mit.edu/courses/architecture/4-411-building-technology-laboratory-spring-2004/lecture-notes/

ME15407 MANUFACTURING TECHNOLOGY LABORATORY II 0 0 4 2

COURSE OBJECTIVES

- To give practical hands-on exposure to students in the various metal cutting operations through commonly used machine tools
- To gain hands on experience on working of general purpose machine tools and various manufacturing processes.

List of Experiments

1. Measurement of Cutting Force using tool dynamometer
2. Single point tool profile
3. Dove Tail ,Surface Finishing,Spline
4. Generating of Contour Profile (Concave & Convex)
5. Making a Keyway(External & Internal)
6. Making Spur gear & Helical gear.
7. Cylindrical grinding & Surface Grinding opeartions

TOTAL: 60 PERIODS

COURSE OUTCOMES

At the end of the course the students will be able to

- fabricate spur gear, helical gear, internal and external Keyway using machine tools
- carry out cylindrical grinding & Surface Grinding operations.

WEB LINKS

- http://home.iitk.ac.in/~bhattacs/LABORATORY_MANUAL.pdf
- http://ggnindia.dronacharya.info/medept/Downloads/Labmanuals/Odd/Sem_V/MT-II_LM-319F_VSem.pdf

ME15408 STRENGTH OF MATERIALS LABORATORY 0 0 4 2

COURSE OBJECTIVES

- To conduct tension test on different metals.
- To conduct compressions test on Spring and Concrete.
- To conduct flexural and torsion test to determine elastic constants.
- To determine hardness of metals.

LIST OF EXPERIMENTS

1. Tension test on mild steel rod
2. Compression test on wood
3. Double shear test on metal
4. Torsion test on mild steel rod
5. Impact test on metal specimen (Izod and Charpy)
6. Hardness test on metals (Rockwell and Brinell Hardness Tests)
7. Deflection test on metal beam
8. Compression test on helical spring
9. Deflection test on carriage spring
10. Test on Cement

TOTAL: 60 PERIODS

COURSE OUTCOMES

At the end of the course the student will be able to

- apply the concepts of mechanics for determining stresses and strains from the member forces.
- solve the problems by knowing the effects of axial loads, bending, shear and torsion on structural components.
- determine the behavior of structural elements such as bars, beams and columns subjected to tension, compression, shear, bending and torsion by means of experiments.
- feel physically the behavior of materials and structural elements including distribution of stresses, strains, deformations and failure modes.

EN15401 BUSINESS ENGLISH COURSE LABORATORY 0 0 2 1

COURSE OBJECTIVES

- To develop the reading skills of the students and make them familiarized in skimming and scanning.
- To instill the communication concepts to enhance the students' conversational skills through various practice sessions and to familiarize them with a variety of business correspondence.
- To inculcate the receptive skills i.e. Listening and Reading and to make the studentswell versed in the Productive skills and to assist them in improving their vocabulary and comprehension of grammar.

UNIT I READING AND VOCABULARY

Understanding short, real notices, messages - detailed comprehension of factual material- skimming & scanning skills - interpreting visual information - reading for detailed factual information - reading for gist and specific information - reading for grammatical accuracy and understanding of text structure - reading and information transfer.

UNIT II WRITING

Re-arranging appointments - asking for permission - giving instructions - apologizing and offering compensation - making or altering reservations - dealing with requests - giving information about a product.

UNIT III LISTENING

Listening to short telephonic conversation - Listening to short conversation or monologue - Listening to specific information - Listening to conversation- interview, discussion.

UNIT IV SPEAKING

Conversation between the interlocutor and the candidate - general interaction and social language - A mini presentation by each candidate on a business theme - organising a larger unit of discourse - giving information and expressing opinions - two way conversation between candidates followed by further prompting from the interlocutor- Expressing opinions- agreeing and disagreeing

TOTAL: 30 PERIODS

COURSE OUTCOMES

On the completion of the course, students will be able to

- enrich the vocabulary through reading and can develop their pronunciation skills.
- speak effectively in English on all occasions.
- prepare flawless reports and proposals.

TEXT BOOKS

1. Cambridge BEC Preliminary, Self Study Edition, Cambridge University Press, New York, 2012.
2. Whitby, Norman. Business Benchmark, Pre-intermediate to intermediate, Business Preliminary, Shree

3. Maitrey Printech Pvt. Ltd., Noida, 2014.

REFERENCES

1. Raman, Meenakshi & Sangeetha Sharma. Technical Communication: Principles and Practice.
2. Oxford University Press, New Delhi. 2011.
3. Rizvi, Ashraf. M. Effective Technical Communication. Tata McGraw-Hill, New Delhi. 2005
4. Rutherford, Andrea. J Basic Communication Skills for Technology. Pearson, New Delhi. 2001.

WEBLINKS

1. http://www.cambridge.org/us/cambridgeenglish/catalog/cambridge-english-exams-ielts/business-benchmark