UNIVERSITY OF KERALA

B. TECH. DEGREE COURSE

(2013 SCHEME)

SYLLABUS FOR

III SEMESTER

MECHANICAL ENGINEERING

SCHEME -2013

III SEMESTER
MECHANICAL ENGINEERING (M)

Course No	Name of subject	Credits	Weekly load, hours			C A Marks	Exam Duration Hrs	U E Max Marks	Total Marks
			L	T	D/P				
13.301	Engineering Mathematics-II (ABCEFHMNPRSTU)	4	3	1	-	50	3	100	150
13.302	Humanities (BEFMRSU)	3	3	-	-	50	3	100	150
13.303	Fluid Mechanics(MS)	4	3	1	-	50	3	100	150
13.304	Mechanics of Solids (MNPSU)	4	3	1	-	50	3	100	150
13.305	Computer Programming and Numerical Methods (MP)	3	2	1		50	3	100	150
13.306	Engineering Drawing (MP) Part A: Machine Drawing	5	-	-	2	25	4	50	150
	Part B: Civil Engineering Drawing & Estimation		1	-	2	25		50	
13.307	Thermal Engineering(MU)	4	3	1	-	50	3	100	150
13.308	Civil Engineering Lab (MP)	2	-	-	2	50	3	100	150
	Total	**29**	**18**	**5**	**6**	**400**		**800**	**1200**

13.301 ENGINEERING MATHEMATICS - II (ABCEFHMNPRSTU)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits**: 4

Course Objective:

This course provides students a basic understanding of vector calculus, Fourier series and Fourier transforms which are very useful in many engineering fields. Partial differential equations and its applications are also introduced as a part of this course.

Module – I

Vector differentiation and integration: Scalar and vector functions-differentiation of vector functions-velocity and acceleration - scalar and vector fields - vector differential operator-Gradient-Physical interpretation of gradient - directional derivative – divergence - curl - identities involving ∇ (no proof) - irrotational and solenoidal fields - scalar potential.

Vector integration: Line, surface and volume integrals. Green's theorem in plane. Stoke's theorem and Gauss divergence theorem (no proof).

Module – II

Fourier series: Fourier series of periodic functions. Dirichlet's condition for convergence. Odd and even functions. Half range expansions.

Fourier Transforms: Fourier integral theorem (no proof) –Complex form of Fourier integrals-Fourier integral representation of a function- Fourier transforms – Fourier sine and cosine transforms, inverse Fourier transforms, properties.

Module – III

Partial differential equations: Formation of PDE. Solution by direct integration. Solution of Langrage's Linear equation. Nonlinear equations - Charpit method. Homogeneous PDE with constant coefficients.

Module – IV

Applications of Partial differential equations: Solution by separation of variables. One dimensional Wave and Heat equations (Derivation and solutions by separation of variables). Steady state condition in one dimensional heat equation. Boundary Value problems in one dimensional Wave and Heat Equations.

References:

1. Kreyszig E., *Advanced Engineering Mathematics*, 9/e, Wiley India, 2013.
2. Grewal B. S., *Higher Engineering Mathematics*, 13/e, Khanna Publications, 2012.

3. Ramana B.V., *Higher Engineering Mathematics*, Tata McGraw Hill, 2007.
4. Greenberg M. D., *Advanced Engineering Mathematics*, 2/e, Pearson, 1998.
5. Bali N. P. and M. Goyal, *Engineering Mathematics*, 7/e, Laxmi Publications, India, 2012.
6. Koneru S. R., *Engineering Mathematics*, 2/e, Universities Press (India) Pvt. Ltd., 2012.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

At the end of the course, the students will have the basic concepts of vector analysis, Fourier series, Fourier transforms and Partial differential equations which they can use later to solve problems related to engineering fields.

13. 302 HUMANITIES (BEFMRSU)

Teaching Scheme: 3(L) - 0(T) - 0(P) **Credits**: 3

Course Objectives:

- *To explore the way in which economic forces operate in the Indian Economy.*
- *The subject will cover analysis of sectors, dimensions of growth, investment, inflation and the role of government will also be examined.*
- *The principle aim of this subject is to provide students with some basic techniques of economic analysis to understand the economic processes with particular reference to India.*
- *To give basic concepts of book keeping and accounting*

PART I ECONOMICS (2 periods per week)

Module – I

Definition of Economics –Central Economic Problems – Choice of techniques –Production possibility curve – Opportunity Cost-Micro & Macro Economics

Meaning of Demand – Utility-Marginal Utility and Law of Diminishing Marginal Utility-Law of demand - Determinants of Demand – Changes in Demand – Market Demand—Demand, forecasting-Meaning of supply-Law of Supply- Changes in Supply-- Market Price Determination – Implications of Government Price Fixation

Production function – Law of Variable proportion – Returns to scale – Iso-quants and Isocost line- Least cost combination of inputs – Cost concepts – Private cost and Social Cost -

Short run and Long run cost- cost curves – Revenue – Marginal, Average and Total Revenue-Break even Analysis

Module – II

National Income concepts - GNP – GDP – NNP– Per Capita Income – Measurement of National Income-Output method- Income method and Expenditure method -Sectoral Contribution to GDP– Money-Static and Dynamic Functions of Money-Inflation – causes of inflation – measures to control inflation – Demand Pull inflation – cost push inflation – Effects of Inflation – Deflation.

Global Economic Crisis India's Economic crisis in 1991 – New economic policy – Liberalization – Privatization and Globalization-Multinational Corporations and their impacts on the Indian Economy- Foreign Direct Investment (FDI) Performance of India-Issues and Concerns. Industrial sector in India – Role of Industrialization -Industrial Policy Resolutions-Industry wise analysis – Electronics – Chemical – Automobile – Information Technology.

Environment and Development – Basic Issues – Sustainable Development- Environmental Accounting – Growth versus Environment – The Global Environmental Issues- Poverty- Magnitude of Poverty in India- -Poverty and Environment

PART-II- ACCOUNTANCY (1 Period per week)

Module – III

Book-Keeping and Accountancy- Elements of Double Entry- Book –Keeping-rules for journalizing-Ledger accounts-Cash book- Banking transactions- Trial Balance- Method of Balancing accounts-the journal proper(simple problems).

Final accounts: Preparation of trading and profit and loss Account- Balance sheet (with simple problems) - Introduction to accounting packages (Description only).

References

1. Dewett K. K., *Modern Economic Theory,* S Chand and Co. Ltd., New Delhi, 2002.
2. Todaro M., *Economic Development*, Addison Wesley Longman Ltd., 1994.
3. Sharma M. K., *Business Environment in India,* Commonwealth Publishers, 2011.
4. Mithani D.M., *Money, Banking, International Trade and Public Finance*, Himalaya Publishing House, New Delhi, 2012.
5. Dutt R. and K. P. M. Sundaran*, Indian Economy,* S. Chand and Co. Ltd., New Delhi, 2002.
6. Varian H. R., *Intermediate Micro Economics,* W W Norton & Co. Inc., 2011.
7. Koutsoyiannis A., *Modern Micro-economics,* MacMillan, 2003.
8. Batliboi J. R., *Double Entry Book-Keeping,* Standard Accountancy Publ. Ltd., Bombay, 1989.
9. Chandrasekharan Nair K.G., *A Systematic approach to Accounting*, Chand Books, Trivandrum, 2010.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts. Part I and Part II to be answered in separate answer books.

Part I Economics *(70 marks) – Part I shall consist of 2 parts.*

Part A (20 Marks) - Two short answer questions of 10 marks each, covering entire syllabus. All questions are compulsory. (10x2=20marks)

Part B (50 marks) - Candidates have to answer one full question out of the two from Part I (Module I and Module II). Each question carries 25 marks.

Part II Accountancy *(30 marks)*

Candidates have to answer two full questions out of the three from Part II (Module III). Each question carries 15 marks.

Course outcome:

- *The students will be acquainted with its basic concepts, terminology, principles and assumptions of Economics.*
- *It will help students for optimum or best use of resources of the country*
- *It helps students to use the understanding of Economics of daily life*
- *The students will get acquainted with the basics of book keeping and accounting*

13.303 FLUID MECHANICS (MS)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits**: 4

Course Objectives :

- *This is an introductory course in the mechanics of fluid motion.*
- *It is designed to establish fundamental knowledge of basic fluid mechanics and address specific topics relevant to simple applications involving fluids*
- *To familiarize students with the relevance of fluid dynamics to many engineering systems.*

Module – I

Fundamental Concepts: Properties of fluid - Density, Specific weight, viscosity, surface tension, capillarity, vapour pressure, bulk modulus, compressibility, (description only)

Newton's law of viscosity, Newtonian and non- Newtonian fluids, real and ideal fluids, incompressible and compressible fluids.

Fluid Statics: Pressure – Pressure at a point in a fluid, Pascal's Law. Absolute and gauge pressures, Measurement of pressure -Piezo meter, manometers, pressure gauges.

Buoyancy and flotation- forces on bodies and surfaces, stability of floating and submerged bodies, Metacentre and metacentric height. (Simple problems based on pressure measurements and pressure forces on curved and plane surfaces)

Module – II

Fluid Kinematics: Eulerian and Lagrangian approaches, classification of fluid flow, 1-D, 2-D and 3-D flow, steady, unsteady, uniform, non-uniform, laminar, turbulent, rotational, irrotational flows, stream lines, path lines, streak lines, stream tubes, velocity and acceleration in fluid, circulation and vorticity, stream function and potential function, Laplace equation, equipotential lines flow nets, uses and limitations,

Fluid Dynamics: Energies in flowing fluid, head, pressure, dynamic, static and total head, Control volume analysis of mass, momentum and energy, Equations of fluid dynamics: Differential equations of mass, energy and momentum (Euler's equation), Navier-Stokes equations (without proof) for rectangular and cylindrical co-ordinates, Bernoulli's equation and its applications: Venturi and Orifice meters, Notches and Weirs (description only for notches and weirs). Velocity measurements: Pitot tube and Pitot-static tube.

Module – III

Pipe flow: Viscous flow: Reynolds experiment to classify laminar and turbulent flows, significance of Reynold's number, critical Reynold's number, shear stress and velocity

distribution in a pipe, law of fluid friction, head loss due to friction, Hagen Poiseuille equation. Turbulent flow: Darcy- Weisbach equation, Chezy's equation Moody's chart, Major and minor energy losses, hydraulic gradient and total energy line, flow through long pipes, pipes in series, pipes in parallel, equivalent pipe, siphon, transmission of power through pipes, efficiency of transmission, Water hammer, Cavitation.

Module – IV

Concept of Boundary Layer: Growth of boundary layer over a flat plate and definition of boundary layer thickness, displacement thickness, momentum thickness and energy thickness, laminar and turbulent boundary layers, laminar sub layer, velocity profile, Von-Korman momentum integral equations for the boundary layers, calculation of drag, separation of boundary and methods of control.

Dimensional analysis: Scope of dimensional analysis - dimensional homogeneity, Buckingham's π theorem method - model testing - similitude- classification of models, various types of forces acting in a fluid flow, Dimensionless numbers, model laws - Froude, Reynold, Weber, Cauchy and Mach. laws –applications and limitations of model testing. *(Only descriptions needed in this section)*

References:

1. Modi P. N. and S. M. Seth, *Hydraulics & Fluid Mechanics*, S.B.H Publishers, New Delhi, 2002.
2. Bansal R. K., *A Textbook of Fluid Mechanics and Hydraulic Machines*, Laxmi Publications, 2005.
3. Streeter V. L., E. B. Wylie and K. W. Bedford*, Fluid Mechanics*, Tata McGraw Hill, Delhi, 2010.
4. Kumar D. S., *Fluid Mechanics and Fluid Power Engineering,* S. K. Kataria & Sons, New Delhi, 1998.
5. Douglas J. F., Fluid Mechanics, 4/e Pearson Education, 2005.
6. Fox R. W. and A. T. McDonald, *Introduction to Fluid dynamics*, 5/e, John Wiley and Sons, 2009.
7. Subramanya K., *Theory and Applications of Fluid Mechanics*, Tata McGraw Hill, 1993.
8. Shames I. H., *Mechanics of Fluids*, McGraw Hill, 1992.
9. White F.M., *Fluid Mechanics*, 6/e, Tata McGraw Hill, 2008.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

Students successfully completing this course are expected to:

- *Learn the Fluid properties and principles of Fluid statics, kinematics and dynamics.*
- *Calculate pressure variations in accelerating fluids using Euler's and Bernoulli's equations*
- *Conversant with the concepts of flow measurements and flow through pipes*
- *Apply the momentum and energy equations to engineering problems.*
- *Evaluate head loss in pipes and conduits.*
- *Use dimensional analysis to design physical or numerical experiments and to apply dynamic similarity.*

13.304 MECHANICS OF SOLIDS (MNPSU)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits**: 4

Course Objectives:

- *To acquaint with the basic concepts of stress and deformation in solids.*
- *To practise the methodologies to analyse stresses and strains in simple structural members and to apply the results in simple design problems.*

Module – I

Concept of stress – normal stress and shear stress, concept of strain, normal strain and shear strain, constitutive relation, Hooke's law, modulus of elasticity, modulus of rigidity, deformation of axially loaded bars, members with varying cross section, principle of superposition, composite bars, thermal stress. Saint-Venant's Principle and stress concentration.

Module – II

Linear strain and lateral strain, Poisson's ratio, volumetric strain, bulk modulus of elasticity, relationship between elastic constants.

Concept of stress and strain tensor, generalised Hooke's law. Definition of plane stress, plane strain and examples. Stress transformation (2D only) principal stress and Mohr's circle, Strain energy due to axial loads- gradually and suddenly applied impact loads.

Module – III

Shear force and bending moment diagrams– cantilever, simply supported and over hanging beams-concentrated and UD loads, Theory of simple bending: bending stress and shear stress distribution-rectangular, circular and I sections. Slope and deflection of beams, load-deflection differential equation, computation of slope and deflection of simply supported and cantilever beams- Macaulay's method.

Module – IV

Torsion of circular shafts-solid and hollow shafts-power transmitted by shafts. Thin cylinders and shells subjected to internal and external pressures – thick cylinders and spherical shells-Lame's equation – compound cylinders. Direct and bending stress – short columns – core of section Crippling load- Eulers equation. Analysis of pin-jointed plane perfect frames by the method of joints.

References :

1. Popov E. P., *Engineering Mechanics of Solids*, Prentice Hall, 2006.
2. Timoshenko S., *Strength of Materials Part I - Elementary Theory & Problems*, CBS Publishers, 2004.
3. Shames I. H. and J. M. Pitarresi*, Introduction to Solid Mechanics*, Prentice Hall, 2000.
4. Prasad I. B., *Strength of Materials*, Khanna Publishers, Delhi, 2009.
5. Bansal R. K., Strength of Materials, Laxmi Publications, New Delhi, 2004.
6. Rattan S. S., *Strength of Materials*, Tata McGraw-Hill, New Delhi, 2008.
7. Junarkar S. B. and Shah H. J., *Mechanics of Structures (Vol I & II),* Charotar Publishing House, 1999.
8. Singh D. K., *Strength of Materials,* Ane Books India, New Delhi, 2008.
9. Jose S. and Kurian S. M., *Mechanics of Solids*, Pentagon, 2012.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

Student would be able to analyse stresses and strains in simple structural members and to apply the results in simple design problems. This subject will lay foundation to study subjects like mechanics of materials, machine design etc.

13.305 COMPUTER PROGRAMMING & NUMERICAL METHODS (MP)

Teaching Scheme: 3(L) - 0(T) - 0(P) **Credits**: 3

Course Objectives :

To equip students with fundamentals of computer programming and to provide fundamental idea about the use of computer programming and numerical methods for analyzing the basic engineering problems.

Module – I

Introduction to Computer programming concept –internal representation of data - Algorithm and flow chart, Basics of procedure oriented and object oriented programming. Introduction to C++: Structure of C++ program; Keywords; Identifiers; Data types – integer, real, character, string, boolean, enumeration, Constant and Variables; Operators – assignment, arithmetic, relational, logical, increment, decrement and conditional operators; Statements – simple & compound, declaration statements. Input and output streams.

Module – II

Control statements: **if**, **if-else**, **switch**, **for**, **while**, **do-while**, **break** and **continue** statements, Arrays – one dimensional & two dimensional; Functions: inline functions, function over loading, Functions with default arguments, recursion. Basics of Pointers. Function call by value, call by reference. Preparation of programs for evaluation of Factorial of a number, infinite series, Sorting, Searching and Matrix multiplication.

Module – III

Introduction to Class and Object- definition, data members, member function, private & public member functions, member access, friend declaration, class objects, predefined classes, initialization. Inheritance- base class and derived class. Simple programs using the above features. (Simple programming questions for University exam)

Module – IV

Errors and approximations, sources of errors. Solution of linear system of equations: Gauss elimination, Gauss-Jordan and Gauss–Seidel methods. Interpolation: Lagrange and Aitken techniques. Curve fitting: method of least squares, non-linear relationships, linear correlation, measures of correlation. Solution of Partial differential equations: classification, Laplace equation, Finite difference method. Numerical problems and preparation of computer programs for the above methods.

References :

1. Ravichandran D., *Programming with C++*, Tata McGraw Hill, 2007.
2. Kamthane A. M., *Object Oriented Programming with ANSI & Turbo C++*, Pearson Education, 2009.
3. Lippman S. B. and J. Lajoie, *C++ Primer*, Pearson Education, 2005.
4. Balaguruswamy E., *Object Oriented Programming with C++*, Tata McGraw Hill, 1992.
5. Barkakati N., *Object Oriented Programming in C++*, SAMS, 1991.
6. Jose S., *Computer Oriented Numerical Techniques*, Pentagon, 2011.
7. Gerald C. F. and P. O. Wheatley, *Applied Numerical Analysis*, Pearson Edu., 2004.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (40 marks) - Ten Short answer questions of 4 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (60 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 15 marks.

Note: Questions for writing programs are to be included only from Module II and IV.

Course Outcome:

Students successfully completing this course are expected to have capability to prepare fundamental computer programs and programs for numerical solutions for basic engineering problems like system of equations and heat equations.

13.306 ENGINEERING DRAWING (MP)

Teaching Scheme: 1(L) - 0(T) - 4(P) **Credits**: 4

PART - A

MACHINE DRAWING (0 – 0 – 2)

Course Objective :

- *To provide a general idea about basic sketching, dimensioning and BIS*
- *To provide an overview in preparing drawings of machine components*

Module – I

Introduction to orthographic projection Conversion of pictorial views into Orthographic views plan, elevation, end view and sectional views. Conventions-Dimensioning techniques, BIS standards

Free hand sketching: Screw thread forms and conventional representations, lock nuts, foundation bolts, forms of rivet heads, Riveted Joints – Lap (chain and zigzag with multiple rows), butt joints (chain and zigzag with multiple rows, single strap and double strap), diamond joint, different types of keys, Pipe joint-socket and spigot.

Module – II

Dimensioned drawing: Hexagonal and square headed bolt with nut, Sectional drawings of Socket and spigot joint, Knuckle Joint, Rigid flanged couplings (protected and unprotected), flexible coupling (Bushed or Pin), Plummer block, Single plate clutch and Cone friction clutch. Pipe joints: Sectional drawings of Cast Iron Flanged joint, Hydraulic joint and Union Joint.

References:

1. Bhatt N. D. and V. M. Panchal, *Machine Drawing*, Charotar Publisher, 2002.
2. Varghese P. I., *Machine Drawing*, VIP Publishers, Thrissur, 2012.
3. Gill P. S., *Machine Drawing*, S. K. Kataria & Sons, New Delhi, 2010.
4. Parkinson A. C., *Engineering Drawing*, Pitman & Sons, 1966.

Course Outcome:

At the end of the course, the students will be familiar with the preparation of drawings of machine components

PART – B

CIVIL ENGINEERING DRAWING AND ESTIMATION (1 – 0 – 2)

Course Objective:

This course provides the students an insight into detailed drawings of building components, preparation of drawings and estimation of small residential/industrial buildings.

Module – III

Drawing: Principles of building drawing, preparation of drawing of buildings such as office building, residential building (RCC and tiled roof, single storied and two storied), factory building with steel trusses for small scale industries.

Module – IV

Estimating: Principles of estimation, quantity estimation and cost estimation of building such as residential building and factory buildings.

References:

1. Prabhu B. T. S., Paul V. K and C. Vijayan, *Building Drawing and Detailing*, Spades Publishers, Calicut, 1987.
2. Dutta B. N., *Estimating and Costing in Civil Engineering,* UBS Publishers, 2000.
3. Chakraborti M., *Estimating, Costing, Specification and Valuation in Civil Engineering,* Chakraborti, 2010.

Course Outcome:

At the end of the course, the students will be familiar with the various building components, method of preparing plan, section and front elevation of small residential/industrial buildings and method of estimation.

Internal Continuous Assessment *(Maximum Marks-50 : Part A-25 and Part B- 25)*

40% - Tests (minimum 2)

40% - Class work. Drawing sheets to be prepared from all topics in Modules I, II and III. Assignments such as home work, problem solving, quiz, literature survey, term-project, software exercises, etc. from topics in Module IV

20% - Regularity in the class

University Examination Pattern:

Examination duration: 4 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts. Part A and Part B to be answered in separate answer books.

Part A *(Modules I & II)* ***Machine Drawing*** *(50 marks)*

Module I (20 Marks) - The question paper contains three questions from module I. Each full question carries 10 marks. The candidates have to answer any two full questions out of the three.

Module II (30 Marks) - The question paper contains one compulsory question on dimensioned drawing from module II which carries 30 marks.

Part B *(Modules III & IV)* ***Civil Engineering Drawing and Estimation*** *(50 marks)*

The question paper shall contain 2 questions from each module. Module III carries 30 marks and Module IV carries 20 marks. The candidates have to answer one full question out of the two from each module.

13.307 THERMAL ENGINEERING (MU)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits**: 4

Course Objective:

To provide the students with a elementary ideas of applications of thermodynamics in engineering

Module – I

Steam engineering: T- S diagram, Mollier chart, Steam cycles- Rankine cycle, Modified Rankine cycle, Relative efficiency, Improvement in steam cycles-Reheat, Regenerative and Binary vapor cycle

Steam Boilers: Types of boilers –Cochran boiler, Babcock and Wilcox boiler, Benson boiler, La Mont boiler. Boiler Mountings and Accessoires.

Steam nozzles: Types of nozzle- Velocity of steam, mass flow rate, critical pressure ratio and its significance, effect of friction, super saturated flow.

Steam turbines: classification, compounding of turbines-pressure velocity variation, velocity diagrams, work done, efficiency, condition for maximum efficiency, multistage turbines-condition line, stage efficiency. Steam turbine performance-reheat factor, degree of reaction, cycles with reheating and regenerative heating, governing of turbines.

Module – II

Internal combustion engines: classification of I.C. Engines- four strokes and two strokes I.C. Engines, Comparison of four strokes and two stroke Engines. Wankel engine, Stratified charge engine.

Air standard cycle-Carnot cycle, Otto cycle; Diesel cycle, dual combustion cycle, comparison of Otto, diesel and dual combustion cycles. Stirling and Ericsson cycles, air standard efficiency, specific work output, work ratio; Actual cycle analysis, deviation of actual engine cycle from ideal cycle. Variable specific heats.

Performance Testing of I C Engines: Indicator diagram, mean effective pressure. Torque, Engine power- BHP, IHP. Engine efficiency- mechanical efficiency, volumetric efficiency, thermal efficiency and relative efficiency, Specific fuel consumption. Testing of I C engines-Morse test, Heat balance test and Retardation test.

Module – III

Fuels and fuel combustion: Flash point and fire point, calorific value, Adiabatic flame temperature, Fuels for SI and CI engine, Important qualities of SI and CI engine fuels, Dopes,

Additives, Gaseous fuels, LPG, CNG, Biogas, Producer gas. Analysis of fuel combustion-A/F ratio, equivalence ratio, minimum quantity of air, flue gas analysis, excess air.

Combustion in I.C. Engines: Combustion phenomena in S.I. engines; Ignition limits, stages of combustion in S.I. Engines, Ignition lag, velocity of flame propagation, auto ignition, detonation; effects of engine variables on detonation; octane rating of fuels; pre-ignition; S.I. engine combustion chambers.

Stages of combustion in C.I. Engines; delay period; variables affecting delay period; knock in C.I. engines, Cetane rating; C.I. engine combustion chambers.

Pollutants from S.I. and C.I. Engines

Module – IV

Gas turbines: classification, Thermodynamic analysis of gas turbine cycles-open, closed and semi closed cycle; ideal working cycle- Brayton cycle-P-v and T-s diagram, thermal efficiency. Effect of compressor and turbine efficiencies. Optimum pressure ratio for maximum specific work output with and without considering machine efficiencies. Comparison of gas turbine and IC engines, Analysis of open cycle gas turbine, Improvements of the basic gas turbine cycles-regeneration, intercooling and reheating-cycle efficiency and work output-Condition for minimum compressor work and maximum turbine work. Combustion chambers for gas turbines. Pressure loss combustion process and stability loop.

References:

1. Rajput R. K., *Thermal Engineering*, Laxmi Publications, 2010.
2. Ballaney P. L., *Thermal Engineering*, Khanna publishers, 1994.
3. Rudramoorthy R., *Thermal Engineering*, Tata McGraw Hill, 2003.
4. Gill P. W., J. H. Smith Jr., and Ziurys E. J., *Fundamentals of Internal Combustion Engines*, Oxford and IBH, 1996.
5. Chavan D. K. and G. K. Pathak, *Thermal Engineering, Standard Book House, 2008*.
6. Ganesan V., *Fundamentals of IC engines*, Tata McGraw-Hill, 2000.
7. Eastop T. D. and A. McConkay, *Applied Thermodynamics for Engineering Technology*, Pearson Education, 2009.
8. Heywood J. B., *I.C Engine Fundamentals,* McGraw-Hill, 1988.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

After the completion of this course, students will get knowledge in the areas of engines, Gas turbine for a complete understanding of energy and other related engineering systems. It also provides students a feel for how thermal sciences are applied in engineering practice.

13.308 CIVIL ENGINEERING LAB (MP)

Teaching Scheme: 0(L) - 0(T) - 2(P) **Credits**: 2

Course Objective :

- *To demonstrate the basic principles and important concepts in the area of strength and mechanics of materials and structural analysis to the students through a series of experiments.*
- *To give an introduction to the use of Levelling instruments and Theodolites*

Part I : List of Experiments:

1. Test on Mild Steel, High carbon steel and Cast Iron specimens
2. Shear test on MS Rod
3. Torsion test on MS Rod
4. Torsion test using Torsion Pendulum on MS, Aluminium and Brass wire
5. Izod and Charpy Impact tests
6. Hardness test (Brinell Hardness & Rockwell Hardness)
7. Spring test (Open and closed coiled)
8. Bending test on Wood
9. Determination of Moment of Inertia of Rotating Bodies

Part II : Exercises using Levelling instruments and Theodolites (4 Classes)

Internal Continuous Assessment *(Maximum Marks-50)*

40% - Test
40% - Class work and Record
20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

Questions based on the list of experiments prescribed.

80% - Procedure, conducting experiment, results, tabulation and inference

20% - Viva voce (based on Part I and II)

Candidate shall submit the certified fair record for endorsement by the external examiner.

Course Outcome:

This subject will lay foundation to study subjects like mechanics of materials, machine design etc. It also provides students a feel for how various engineering properties of materials are applied in engineering practice. The students will have the basic awareness of survey using level and theodolite.