UNIVERSITY OF KERALA

B. TECH. DEGREE COURSE

(2013 SCHEME)

SYLLABUS FOR

III SEMESTER

MECHANICAL - STREAM - PRODUCTION ENGINEERING

SCHEME -2013

III SEMESTER

MECHANICAL - STREAM - PRODUCTION ENGINEERING (P)

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	Fluid Mechanics & Hydraulic Machines(P)	5	4	1	-	50	3	100	150
13.303	Mechanical Technology(P)	3	2	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	Fluid Mechanics & Machines Lab (P)	3	-	-	3	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 FLUID MECHANICS AND HYDRAULIC MACHINES (P)

Teaching Scheme: 4(L) - 1(T) - 0(P) **Credits**: 5

Course Objectives :

- *To introduce students, the fundamental concepts related to the mechanics of fluids. Understandings of the basic principles of fluid mechanics.*
- *To apply acquired knowledge on real life problems. Analyze existing fluid systems and design new fluid systems.*

Module – I

Fundamental concepts: Properties of fluid - Density, Specific weight, viscosity, surface tension, capillarity, vapour pressure, bulk modulus, compressibility. Newton's law of viscosity-Newtonian and Non Newtonian fluids, Ideal fluids and real fluids, Incompressible and Compressible fluids.

Fluid Statics: Pressure and its measurements – Pressure at a point in a fluid, Pascal's Law. Absolute and gauge pressures, Measurement of pressure -Piezo meter, manometers (simple U tube, differential and micro), pressure gauges. Buoyancy and floatation-Meta -centre and Meta-centric height, Stability of floating bodies.

Fluid kinematics: Classification of fluid flow -1D, 2D and 3D flow, steady, unsteady, uniform, non-uniform, laminar, turbulent, rotational, irrotational flows, stream lines, path lines, streak lines, stream tubes, stream function and potential function, Laplace equation, equipotential lines, flow nets uses and limitations.

Fluid dynamics: Energies in flowing fluid, pressure head, dynamic head, static and total head. Euler's equation. Bernoulli's equation from Euler's equation and its applications-Venturimeter (three positions) and Orifice meters-Coefficient of discharge. Flow through orifices-Determination of Cv C_c and C_d. Notches-rectangular, triangular and trapezoidal notches and Weirs (No derivations). Pitot tube and Pitot-static tube.

Module – II

Pipe flow: Viscous flow: Reynolds experiment-laminar and turbulent flow, 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 losses. Flow through pipes- pipes in series, parallel, equivalent pipe, siphon, and transmission of power through pipes, efficiency of transmission, Water hammer, Cavitation.

Module – III

Impact of jets: Stationary and moving vanes – Flat and curved vanes – Series of vanes - work done and efficiency. Hydraulic Turbines: Impulse and Reaction Turbines – Pelton Wheel – Constructional features - Velocity triangles – Speed ratio, jet ratio & work done, losses and efficiencies, design of Pelton wheel. Reaction Turbines– Francis Turbine – Constructional features –Velocity triangles, work done and efficiencies – Kaplan turbine -Constructional features – Velocity triangles- work done and efficiencies –Characteristic curves of turbines – theory of draft tubes – surge tanks– Specific speed of turbine.

Similarity and model testing: Type Number– Characteristic curves, scale Laws – Unit speed – Unit discharge and Unit power.

Module – IV

Positive displacement pumps: Reciprocating pump –– separation and cavitation - slip, negative slip and work required and efficiency- indicator diagram- effect of acceleration and friction on indicator diagram – air vessels and their purposes, multi cylinder pumps.

Rotary motion of liquids: – free, forced and spiral vortex flows- rotodynamic pumps-centrifugal pump impeller, casings –manometric head- work, efficiency and losses, priming, specific speed. Performance characteristics-multistage pumps-pumps in series and parallel - selection of pumps.

Hydraulic ram, accumulators and intensifier: principles of working- gear pumps.

References:

1. Modi P. N. and S. M. Seth, *Hydraulics & Fluid Mechanics*, S.B.H Publishers, New Delhi, 2002.
2. Balachandran P., *Fluid Mechanics and Hydraulic Machines*, Prentice Hall India Ltd. 2011.
3. Bansal R. K., *A Textbook of Fluid Mechanics and Hydraulic Machines*, Laxmi Publications, 2005.
4. Streeter V. L., E. B. Wylie and K. W. Bedford*, Fluid Mechanics*, Tata McGraw Hill, Delhi, 2010.
5. Kumar D. S., *Fluid Mechanics and Fluid Power Engineering,* S. K. Kataria & Sons, New Delhi, 1998.
6. Douglas J. F., Fluid Mechanics, 4/e Pearson Education, 2005.
7. Fox R. W. and A. T. McDonald, *Introduction to Fluid dynamics*, 5/e, John Wiley and Sons, 2009.
8. Subramanya K., Theory and Applications of Fluid Mechanics, Tata McGraw-Hill, 1993.
9. Shames I. H., *Mechanics of Fluids*, McGraw-Hill, 1992.

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:

Up on completion of the course, the aspirants might be in a position to

- *Analyze flow problems associated with statics, kinematics and dynamics of fluids.*
- *Design and analyze fluid devices such as water turbines and pumps*
- *Understand and rectify problems faced in practical cases of engineering applications.*

13. 303 MECHANICAL TECHNOLOGY (P)

Teaching Scheme: 2(L) - 1(T) - 0(P) **Credits**: 3

Course Objectives :

- *To provide the students with a foundation in the area of heat transfer and related field.*
- *To impart knowledge of mechanical power generation devices.*
- *To impart knowledge of low temperature and its applications*
- *To recognize the aspect of engineering problems solvable by applying the subject,*

Module – I

Heat transfer - Field of application- Modes of heat transfer- Conduction- Fourier law of heat conduction, heat flux and thermal conductivity-variation of conductivity. Factors affecting conductivity- General Heat Conduction Equation in Cartesian Coordinate- thermal diffusivity,. One-dimensional steady state conduction through plane walls, hollow cylinders, hollow spheres and their composites with constant conductivity- thermal resistance and equivalent thermal resistance. Conduction with variable thermal conductivity.

Convection - classification-Newton law of cooling, heat transfer coefficient, Buckingham's Pi theorem and its application to Natural and forced convection heat transfer, combined conduction and convection-overall heat transfer coefficient, Critical radius of insulation and its significances.

Module – II

Radiation heat transfer - Basic theory of radiation-Spectrum of electromagnetic radiation, Reflection, Absorption and Transmission of radiation - absorptivity, reflectivity and transmissivity-Monochromatic radiation-Laws of radiations- Stefan Boltzman law, Planck's law, Kirchoffs law and Wien's displacement law, Total emissive power-. Black body, Grey body and emissivity.

I C Engines – Classification - two-stroke and four stroke engines(Working), theoretical and actual working cycles– SI and CI engines – mean effective pressure– Brake power , Indicated power, efficiencies. Performance test- Morse test – Retardation test – Heat balance test., Governing of I C Engines. Combustion phenomena in SI and CI engines- detonation, knocking and alternate fuels.

Heat exchangers - Classifications- temperatures variation in Parallel flow, counter flow HE, evaporator and condenser. Analysis of Heat Exchangers –LMTD and NTU methods.

Module – III

Compressors - Classifications- reciprocating compressor-p-v diagram, work done, effect of Clearance, efficiencies, volumetric efficiency and free air delivered (FAD), two stage compressions, optimum pressure ratio, effect of intercooling. Rotary compressors- Roots blowers and vane compressors.

Gas turbines - Classifications-open, closed and semi closed cycle, working cycles, efficiency, work output, maximum specific work output. Effect of compressor and Turbine efficiency. Analysis of open cycle – Modified cycles - regeneration, intercooling, reheating.

Module – IV

Refrigeration - Definition, Classification and Unit of refrigeration. Air cycles-reversed Carnot cycle, Bell Coleman cycle, COP, method of improving COP. Vapour compression refrigeration-layout, T-s and p-h diagram, simple saturated cycle, wet, superheated and sub cooled cycle-effect of sub cooling and superheating- Liquid suction heat exchanger.

Refrigerants - properties, selection and designations. Common refrigerants in use. Environmental impacts of refrigerants and Protocols. Absorption refrigeration - Layout-Ammonia –water system and Electrolux system.

Air conditioning – Psychrometriy - basic definitions, psychometric chart, psychometric process- simple load Calculation in air conditioning systems.

References:

1. Ballaney P. L., *Thermal Engineering*, Khanna publishers, 1994.
2. Arora C. P., *Refrigeration and Air conditioning,* Tata McGraw Hill, 2000.
3. Sachdeva R. C., *Fundamentals of Engineering Heat and Mass Transfer*, New Age Science Ltd., 2009.
4. Rajput R. K., *Heat and Mass Transfer,* S. Chand & Co. Ltd., 2007.
5. Eastop T. D. and A. McConkay, *Applied Thermodynamics for Engineering Technology*, Pearson Education, 2009.
6. Rajput R. K., *Thermal Engineering*, Laxmi Publications, 2010.

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.

Note: *Use of approved data book permitted*

Course outcome:

After successful completion of the course, the student will be able to

- *Identify heat transfer equipment and the theory behind them*
- *Understand working principles and performances of I C engines, which leads him to know more about automobiles and to search for improved performances*
- *Know the principles and working of refrigerators and air conditioning equipment in various fields.*

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 Education, 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 FLUID MECHANICS & MACHINES LAB (P)

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

Course Objective:

To demonstrate the applications of the basic fluid mechanics, flow devices and hydraulic machines and to provide a more intuitive and physical understanding of the theory

Part I : Preliminary study:

1. Study of meters, gauges and valves - pressure gauge, vacuum gauge, manometers, micrometer gauge, and flow measuring equipments-water meters-venturi meter-orifice meter-current meter, stop valve, gate valve and foot valve.
2. Study of pumps- centrifugal and reciprocating type. (Description with layout)
3. Study of Turbines- impact and reaction types. (Pelton, Francis and Kaplan) (Description with layout)

Part II: List of Experiments:

1. Determination of Darcy's coefficient and Chezy's constant.
2. Coefficient of discharge and calibration of Notches, (Any one type)
3. Coefficient of discharge and calibration Venturi meters and Orifice meters.
4. Experimental determination of Hydraulic coefficients of a circular orifice.
5. Performance test on Rotodynamic and Positive displacement pumps [specific speed, economic running cost]
6. Performance test on Impulse and Reaction turbines[specific speed]
7. Speed variation test on Pelton Turbines
8. Economic Gate opening test on Francis Turbines
9. Experimental determination of Meta-centric height of floating vessel
10. Reynolds Experiment

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 in Part II.

75% - Theory, Procedure and tabular column (30%);

Conducting experiment, Observation, Tabulation with Sample calculation (30%)

Graphs, Results and inference (15%)

25% - Viva voce (Based on Part I and Part II)

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

Course Outcome:

The students gain practical experience of performances of flow devices and machines which they had acquainted from the subjects like fluid mechanics, hydraulic machines and design etc.

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.