UNIVERSITY OF KERALA

B. TECH. DEGREE COURSE

(2013 SCHEME)

SYLLABUS FOR

III SEMESTER

MECHANICAL - STREAM - INDUSTRIAL ENGINEERING

SCHEME -2013

III SEMESTER

MECHANICAL - STREAM - INDUSTRIAL ENGINEERING (N)

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	Introduction to Industrial Engineering (N)	3	3	-	-	50	3	100	150
13.303	Fluid Mechanics and Machines (N)	3	3	-	-	50	3	100	150
13.304	Mechanics of Solids (MNPSU)	4	3	1	-	50	3	100	150
13.305	Theory of Machines (N)	4	3	1	-	50	3	100	150
13.306	Electrical Machines (N)	4	2	-	2	50	3	100	150
13.307	Computer Aided Drafting Lab (N) Part A: Machine Drawing	4	-	-	2	25	3	50	150
	Part B: Building Drawing		-	-	2	25	3	50	
13.308	Machine Dynamics and Material Testing Lab (N)	3	-	-	3	50	3	100	150
	Total	**29**	**17**	**3**	**9**	**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 INTRODUCTION TO INDUSTRIAL ENGINEERING (N)

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

Course Objectives:

- To understand the principles of management and role of industrial engineering in organisations.
- To learn the methods and techniques to effectively manage productivity of an organisation.
- To understand double entry book keeping and financial statements.
- To learn methods to predict profit through cost volume profit analysis.

Module – I

Industrial Engineering: History, contribution of various pioneers, scope, objectives, application and role of Industrial Engineering in organisations, Industrial Engineering in the modern world, principles of management, management functions, management verses Industrial Engineering. Industrial ownership: Introduction, types of ownership, partnership, joint stock company, private limited company, public limited company, public sector and private sector, different scales and levels of industries.

Module – II

Organisation: Types of organisations, Span of management, Authority and responsibilities, Centralisation & Decentralisation, Linear and staff Authority. Product Design & Development: Principles of good product design, tolerance in design, quality and cost consideration, product life cycle, standardization, simplification, diversification. Intellectual property system: Definition, Importance, TRIPS and its implication, patent, copy right, Industrial design and Trade mark.

Module – III

Problem Solving: Introduction, basic concepts and models, need for creativity, the creative individual, creative thinking, action programs. Decision making: Styles of decision making, contingency approach and decision making tools. Probability Theory: basic concepts, Normal, Poisson, and Binomial probability distributions, use of probability theory in decision making (simple problems only). Productivity measurement and improvement: Introduction, nature and importance of productivity, importance of productivity improvement, factors affecting productivity. Value Engineering and analysis: Concepts, methodology and

applications. Evaluation and management of human resources: Introduction, subjective aspects of performance, selection and training of personnel.

Module – IV

Book keeping and accounting: Double entry book keeping, Preparation of Trading and Profit and Loss account, Balance sheet, Cost-Volume-Profit analysis, Cost accountancy and methods of depreciation.

References:

1. Robbins S. P., D. A. De Cenzo and M. K. Coulter, *Fundamentals of Management*, Pearson Education, 2012.
2. Hicks P. E., *Introduction to Industrial Engineering and Management Science*, McGraw Hill, 1977.
3. Black S. and L. W. Porter, *Management – Meeting New Challenges*, Prentice Hall, 2000.
4. Salvendy G., *Hand Book of Industrial Engineering & Management*, John Wiley & Sons, 2001.
5. Koontz H., *Essentials of Management*, Tata McGraw Hill, 2010.
6. Bateman T. S. and S. A. Snell, *Management: Competing in the New Era*, McGraw Hill, 2002.
7. Batliboi J. R*., Double Entry Book Keeping*, Standard Accountancy Publications, 1975.
8. Telsang M., *Industrial Engineering and Production Management*, Dhanpat Rai & Co., 1998.

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: (Maximum Marks: 100)

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: *If use of tables and charts are permitted for the university examination for this course, proper direction of the same should be provided on the facing sheet of the question paper.*

Course outcome:

After completion of this programme, students are expected to have an understanding of various tools and techniques for the efficient and effective use of different resources in an industrial organisation and application of these techniques for improving the productivity of an organisation.

13.303 FLUID MECHANICS AND MACHINES (N)

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

Course Objectives :

To understand the basic fluid mechanics principles.

To develop the skills to perform the analysis and design of fluid mechanic systems.

To develop the skills to accurately articulate fluid mechanics issues using proper fluid mechanics concepts.

Module – I

Properties of fluids - density, specific gravity, specific weight, surface tension, capillarity, vapour pressure. Fluid statics - pressure, Pascal's law, manometers and pressure gauges - Forces on planar and curved surfaces immersed in fluids, centre of pressure, buoyancy, equilibrium of floating bodies, metacentre and metacentric height - Kinematics - classification of flow, path line, streak line and stream line, acceleration, rotation and vorticity - Continuity equation - momentum conservation equation - derivation of Euler's equation along a stream line - Bernoulli's equation, hydraulic coefficients, venturimeter, orifice apparatus, orifice meter, pitot tube, notches and weirs.

Module – II

Laminar and turbulent flows - Reynold's experiment - Viscous flows - Hagen Poiseuille's equation, average velocity, friction factor, Darcy-Weisbach equation, Chezy's constant, Moody's chart, minor losses in pipes, transmission of power through pipes, flow through pipes in series and parallel, boundary layer theory, boundary layer thickness, displacement thickness, momentum thickness, wall shear stress.

Module – III

Dimensional analysis - Dimensions and units - the Buckingham theorem. Discussions on dimensionless parameters. Models and similitude. Model Laws, Application and limitations of model testing.

Impact of jets on vanes - flat, curved, stationary and moving vanes - radial flow over vanes. Hydroelectric power plant, penstock, surge tank. Hydraulic turbines - classification - Pelton wheel, Francis turbine and Kaplan turbine - work done and efficiency - draft tube - governing - cavitation - specific speed - similarity and model testing of turbines - selection of water turbines for power plants - performance characteristics.

Module – IV

Positive displacement pumps - reciprocating pumps - inertia pressure - air vessels and their purpose - separation and cavitation - slip and efficiency - multi-cylinder pumps. Rotary motion of liquids - free, forced, spiral, and vortex flow. Rotodynamic pumps - centrifugal pumps - impeller, casing - manometric heads, work, efficiency and losses - priming - specific speed. Performance characteristics - multistage pumps - selection of pumps - pumping devices - hydraulic ram, jet pumps, gear pumps, vane pump, lobe pump, rotary pumps.

References:

1. White F. M., *Fluid Mechanics*, 6/e, Tata McGraw Hill, 2008.
2. Kumar D. S., *Fluid Mechanics and Fluid Power Engineering,* S. K. Kataria & Sons, New Delhi, 1998.
3. Kumar K. L., *Engineering Fluid Mechanics*, S. Chand Ltd., 2008.
4. Lewitt E. H., *Hydraulics and Fluid Mechanics*, Pitman, 1961.
5. Jagdish Lal, *Hydraulics and Fluid Mechanics*, Metropolitan Book Co., 1983.
6. Rao N. S. G., *Fluid Flow Machines*, Tata McGraw Hill, 1983.
7. Modi P. N. and S. M. Seth, *Hydraulics & Fluid Mechanics*, S.B.H Publishers, New Delhi, 2002.
8. Douglas J. F., Fluid Mechanics, 4/e Pearson Education, 2005.
9. Fox R. W. and A. T. McDonald, *Introduction to Fluid dynamics*, 5/e, John Wiley and Sons, 2009.
10. Subramanya K., *Theory and Applications of Fluid Mechanics*, Tata McGraw-Hill, 1993.

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: *If use of tables and charts are permitted for the university examination for this course, proper direction of the same should be provided on the facing sheet of the question paper.*

Course Outcome:

After the completion of this course, students will get necessary foundation for a complete understanding of fluid mechanics and machines and other related engineering systems. It also provides students a feel for how fluid mechanics is applied in engineering practice.

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.

***Note:** If use of tables and charts are permitted for the university examination for this course, proper direction of the same should be provided on the facing sheet of the question paper.*

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 THEORY OF MACHINES (N)

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

Course Objectives :

- *To understand the layout of linkages in the assembly of a system/machine.*
- *To study the principles involved in assessing the displacement, velocity and acceleration at any point in a link of a mechanism.*
- *To analyse the motion resulting from a specified set of linkages in a mechanism.*
- *To study the application of friction in different devices.*
- *To study the power transmission devices.*
- *To study the use of gyroscopic couples.*
- *To understand the principles in mechanisms used for governing of machines.*

Module – I

Kinematics - links, mechanism, Degrees of freedom, Grashoff's law, four-bar chain, Slider crank chain, inversions and practical applications. Velocity and acceleration diagrams of simple mechanisms. Coriolis components. Friction - laws of friction, pivot and collar friction, Plate and disc clutches. Pressure and wear theories. Belt (flat and V) drives. Ratio of tensions - Effect of centrifugal and initial tension - Condition for maximum power transmission - Open and crossed belt drive.

Module – II

Brakes - block and band brakes, self energizing and self-locking in braking. Dynamometers - transmission and absorption types. Gear profile and geometry, law of gearing, Nomenclature of spur and helical gears, Gear trains - Simple, compound gear trains and epicyclic gear trains. Cams - types of cams, cam profiles, knife edged and roller followers with and without offsets for various types of follower motions.

Module – III

Flywheel - Turning moment diagrams, fluctuation of energy. Governors - types of governors, simple watt governor - Porter, Proell and Hartnell governors. Isochronisms, hunting, sensitivity and stability. Gyroscope - gyroscopic stability, gyroscopic effect on two wheeled vehicles, gyroscopic stabilization of ships and aeroplanes.

Module – IV

Static and dynamic balancing - Single and several masses in different planes, reciprocating and rotating masses, Single and multi cylinder engines (inline). Dynamic analysis of slider cranks mechanism. Vibration - kinematics of vibrating motion, vibration systems having

single degree of freedom, free and force vibration, equilibrium method and Rayleigh's method, Criterion of whirling speed, torsional vibrations -Transverse vibration.

References:

1. Ballaney P. L., *Theory of Machines*, Khanna Publishers, 1987.
2. Bevan T., *Theory of Machines- A Text Book for Engineering Students,* Pearson, 2011.
3. Rao J. S. and R. V. Dukkipati, Mechanism and Machine Theory, Wiley Eastern Ltd., 1992.
4. Malhotra D. R. and H. C. Gupta, *The Theory of Machines*, Satya Prakasam Tech. India Publications, 1989.
5. Gosh A. and A. K. Mallick, *Theory of Machines and Mechanisms*, Affiliated East West Press, 1988.
6. Shigley J. E. and J. J. Uicker, *Theory of Machines and Mechanisms*, McGraw–Hill, 1980.
7. Rattan S. S., *Theory of Machines*, McGraw Hill, 2009.

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: *If use of tables and charts are permitted for the university examination for this course, proper direction of the same should be provided on the facing sheet of the question paper.*

Course Outcome:

After this programme students are expected to have a thorough understanding of different mechanisms and theories which will help in optimising design of machines and equipments and also to solve practical problems in the area of machines and mechanisms.

13.306 ELECTRICAL MACHINES (N)

Teaching Scheme: 2(L) - 0(T) - 2(P) **Credits**: 4

Course Objectives:

- *To impart basic concepts about different electrical machines and transformers.*
- *To equip the students with the knowledge about the principle, characteristics and applications of different electrical machines.*
- *To enable the students to apply their course background to analyze machines and use it for various applications.*

PART I ELECTRICAL MACHINES THEORY

Module – I

DC Machines - principles of operation - EMF equations - types of excitations - separately excited shunt and series excited DC generators - general idea of armature reaction - OCC and load characteristics - simple numerical problems. Principles of DC motors - torque and speed equations - torque - speed characteristic - variations of speed, torque and power with motor current - applications of DC motors. Principles of starting, losses and efficiency - testing - load test - simple numerical problems.

Module – II

Transformers - principles of operation - EMF equation - vector diagrams - regulation, losses and efficiency - OC and SC tests - equivalent circuit - auto transformers - current transformers, voltage transformers - simple numerical problems - Synchronous machines - types - EMF equations - principles of operation of synchronous motor and its applications.

Module – III

Electric traction - systems of power supply - functional schematic of AC electric locomotives - types of motors used in traction systems and methods of speed control - methods of braking.3-Phase induction motors - slip ring and squirrel cage - rotating magnetic field - torque slip characteristics, no load and blocked rotor tests, methods of starting, principle of operation and applications of single phase stepper motor, universal motor. Principle of variable speed drives for induction motor.

Module – IV

Electric heating - resistance furnaces and ovens - methods of temperature control. Electric arc furnaces and induction furnace. High frequency heating - induction and dielectric heating - applications. Dielectric heating - advantages and uses.

References:

1. Theraja B. L. and A. K. Theraja, *A Text book of Electrical Technology*, S Chand, 2005.
2. Pratap H., *Art and Utilisation of Electric Energy*, Dhanapat Rai & Sons, 1980.
3. Mehta V. K., *Principles of Electrical Engineering and Electronics*, S Chand, 1998.
4. Gupta J. B., *A course in Electric Power*, S. K. Kataria & Sons, 2009.

PART II ELECTRICAL LAB

Study of DC Motor, DC Generator, Transformer (single phase), Polyphase induction motor, Synchronous machines.

List of Experiments:

1. OCC of DC self-excited shunt Generator
2. Load Characteristic of shunt generator
3. Load test on Series motor
4. Load Characteristics of compound Generator
5. Load characteristics of single phase transformer
6. Load characteristics of slip ring induction motor
7. Starting and Load test of squirrel cage 3 -phase induction motor
8. Load test on Alternator by Direct Loading
9. Starting and Load test of single phase induction motor - determination of characteristics.

Electrical Workshop:

Wiring Practice in PVC conduit system

1. Two lamps & a plug (independent control)
2. Stair case wiring / Tunnel wiring
3. Main switch & Energy meter connection (Study of earthing system)
4. Fluorescent Lamp & Ceiling Fan connection.

Internal Continuous Assessment Pattern*: (Total Marks: 50)*

Part I Electrical Machines Theory *(30 Marks)*

15 marks - Tests (minimum 2)

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

5 marks - Regularity in the class

Part II Electrical Lab *(20 Marks)*

10 marks - Test

5 marks - Lab work, record works, homework, assignments etc.

5 marks - Regularity in class

University Examination Pattern:

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

University examination will be based on Part I Electrical Machines Theory.

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: *If use of tables and charts are permitted for the university examination for this course, proper direction of the same should be provided on the facing sheet of the question paper.*

Course Outcome:

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

- *Gain knowledge in the analysis of the performance of any electrical machine.*
- *Use the knowledge for different applications in industries.*

13.307 COMPUTER AIDED DRAFTING LAB (N)

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

PART A : MACHINE DRAWING (0 – 0 – 2)

Course Objective:

Understand various machine components and their drafting techniques with respect to industry standards. The student should learn different types of projection techniques. Both manual and computer aided techniques should be learn by the students.

Orthographic Projections of 3D models

At least 2 sheets should be prepared by the students using manual drawing techniques. After completing this, the student may be taught computer aided drafting (2D) techniques. One of the manually drawn sheets should be drafted by the student using AutoCAD or any computer aided drafting software package.

Study and Drafting of Fasteners and Couplings

Students should learn various fasteners and coupling and the concepts of drafting sectional views. At least two manual drawing sheets and computer aided drafted sheets of machine components such as hexagonal nut and bolt, riveted joints, cotter joints, knuckle joints, flange coupling, plummer block and stuffing box, tail stock of lathes etc. should be prepared by the students.

Study on 3D Modeling and Assembly Techniques of Machine Components.

Students should learn 3D modelling features of any software package commonly used in industry and research organizations. Assembly modelling of hexagonal nut and bolt, knuckle joints, valve components with three or four components, clutch plate etc. should be learn by the students.

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 Kogent Learning Solu. Inc., *AutoCAD 2010 in Simple Steps*, Dreamtech Press, 2009.
4 Omura G., *Mastering AutoCAD 2012 and AutoCAD LT 2012*, Wiley India, 2011.
5 Tickoo S., *Pro/Engineer*, CADCIM Technologies, USA, 2008 *(Online).*

Internal Continuous Assessment Pattern: *(Maximum Marks: 25)*

40% - Tests (Manual drawing and CADD)
40% - Sheets, Record work, Class Work, homework etc.
20% - Regularity in the class.

University Examination Pattern: *(Maximum Marks: 50) (See note given at the end)*

University exam duration is 3 hours. Maximum marks for evaluation 100. The university exam question paper shall be prepared for three hours duration consisting three parts as follows. After evaluating out of 100, examiner should report the same out of 50. The student shall produce the certified record of the work done in the laboratory during the examination.

Part I (*30 marks*)

Computer aided drafting of orthographic views of 3D models or Machine components.

Part II (*50 Marks*)

Computer aided drafting of 3D models of Machine components or Assembly modelling of machine components.

Part III (*20 Marks*)

Ten one word / short answer type questions from machine drawing (Especially from fasteners, riveted joints, foundation bolts, Materials, Threads, Valves, Symbols etc.) (This may be conducted like viva voce also).

Course Outcome:

After the completion of this course, students will get basic ideas on machine drawing, various 2D and 3D modelling features in standard software packages that used in industry and research organizations. These help students to develop creativity to formulate conceptual designs for innovations.

PART B: BUILDING DRAWING (0 – 0 – 2)

Course Objective:

The main objectives of this course are to make the students understand the building principles, to enable them to create the plan of a building and to develop the section and elevation of the building as per requirement.

Course Content:

Study of Principles of building drawing, preparation of the plan, section and elevation of the following types of buildings (different layouts can be prepared for each type):

1. Office building (for 20 staff).
2. A residential building with tiled roof.
3. A single storied residential building with RCC flat roof.
4. A double storied residential building with RCC flat roof.
5. A factory building with steel trusses. etc.

Internal Continuous Assessment: *(Maximum Marks: 25)*

40% - for final test

40% - for lab report, record work, class work, homework etc.

20% - Regularity in the class

University Examination Pattern: *(Maximum Marks: 50) (See note given at the end)*

University exam duration is 3 hours. Maximum marks for evaluation is 100. The university exam question paper shall be prepared for three hours duration with or without different parts/sections. The evaluation should be based on appropriate spilt of marks suitable to the question. After evaluating out of 100, examiner should report the same out of 50. The student shall produce the certified record of the work done in the laboratory during the examination.

Note: Conduction of University Lab Examination:

University lab examination duration is 3 hours each for Part A: Machine drawing and Part B: Building drawing separately. The lab exams can be conducted separately on different days (may be parallel) under the Chairman of Exam for third semester M&N and the Chairman of Exam for third semester Civil Engineering. After evaluating out of 100, each examiner should report the same out of 50 to the respective chairmen.

Course Outcome:

After the completion of this course students will get necessary foundation for preparing the plan, section and elevation of all types of buildings.

13.308 MACHINE DYNAMICS AND MATERIAL TESTING LAB (N)

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

PART A MACHINE DYNAMICS LAB

Course Objective:

To make the students understand the theory of machines through practicals.

List of Experiments:

1. Universal Governor Apparatus
    a) Determination of speed and sensitivity of Watt governor
    b) Determination of speed and sensitivity of Proel governor
    c) Determination of speed and sensitivity of Porter governor
2. Determination of whirling speed of shaft
3. Cam Study Analysis (Circular cam with roller, knife edge and flat follower)
4. Pendulum Experiment
    a) Simple pendulum Experiment
    b) Bifilar suspension Pendulum Experiment
    c) Compound pendulum Experiment
5. Torsional vibration
    a) Single rotor Torsional vibration experiment
    b) Single rotor Torsional vibration experiment
6. Journal bearing experiment

Internal Continuous Assessment: (Maximum Marks: 25)

40% - Tests (final lab test)

40% - Lab work, record works, homework, assignments etc.

20% - Regularity in the class

University Examination Pattern: *(See Note given at the end)*

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

Questions based on the list of experiments prescribed. Question paper shall be prepared for three hours duration with or without different parts / sections. The evaluation should be based on appropriate spilt of marks suitable to the question. General guidelines:

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

20% - Viva voce

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

Course Outcome:

After the completion of this course, students will get necessary practical background of machines theory.

PART B MATERIAL TESTING LAB

Course Objective:

To acquire knowledge on material testing principles and use of destructive testing equipment.

List of Experiments:

Introduction: Study of UTM, Torsion, hardness and Impact testing Machines

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 (Rockwell and Brinell)
7. Spring test (Open and closed)
8. Bending and Compression test on Wood

Internal Continuous Assessment: *(Maximum Marks: 25)*

40% - Tests (final lab test)

40% - Lab work, record works, homework, assignments etc.

20% - Regularity in the class

University Examination Pattern: *(See Note given at the end)*

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

Questions based on the list of experiments prescribed. Question paper shall be prepared for three hours duration with or without different parts / sections. The evaluation should be based on appropriate spilt of marks suitable to the question. General guidelines:

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

20% - Viva voce

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

Course Outcome:

After completion of this programme, students are expected to have knowledge on material testing principles and use of destructive testing equipment.

Note: Conduction of University Lab Examination:

University examination duration is 3 hours each for machine dynamics lab and material testing lab. The student will be evaluated in any one of the labs (either Machine dynamics lab or Material testing lab) for the university examination based on draw of lots. The lab examinations should be conducted in parallel on same days under the Chairman of Exam for third semester M&N (Machine dynamics lab) and the Chairman of Exam for third semester Civil Engineering (Material testing lab).