UNIVERSITY OF KERALA

B. TECH. DEGREE COURSE

(2013 SCHEME)

SYLLABUS FOR

III SEMESTER

MECHANICAL - STREAM - AUTOMOBILE ENGINEERING

SCHEME -2013

III SEMESTER

MECHANICAL - STREAM - AUTOMOBILE ENGINEERING (U)

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	Auto Chassis (U)	5	3	1	1	50	3	100	150
13.304	Mechanics of Solids (MNPSU)	4	3	1	-	50	3	100	150
13.305	Auto Chassis Lab (U)	2	-	-	2	50	3	100	150
13.306	Machines and Auto Component Drawing (U)	5	1	-	4	50	3	100	150
13.307	Thermal Engineering(MU)	4	3	1	-	50	3	100	150
13.308	Heat Engines Lab (U)	2	-	-	2	50	3	100	150
	Total	**29**	**16**	**4**	**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 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 AUTO CHASSIS (U)

Teaching Scheme: 3(L) - 1(T) - 1(P) **Credits**: 5

Course Objectives:

To introduce the basics, working principle and construction of all the Automobile Chassis Components.

Module – I

Introduction: Profile of Automobile Industry, Types of automobiles, general considerations relating to chassis layout and power plant Location, relative merits & demerits of different layouts, description of different types of chassis layout.

Frames and body: Role and requirement of a chassis frame. loads acting on frames Types of chassis – Light, medium and heavy duty vehicle chassis, ladder chassis, Types of Frames (conventional, integral construction and perimeter frame) materials, cross members and X members, frame sections, defects in frames, frame repairs, frame alignment. integral body. Design features of a body – Types of bodies, coach built, convertibles. Body accessories, bumpers.

Module – II

Front axle and steering system: Front axle construction, stub axles, dead axle & live axle, front wheel assembly, steering geometry / wheel alignment - castor, camber, kingpin inclination, toe-in, toe-out, Condition for true rolling, effects of wheel misalignments, Ackerman & Davis steering gear, different types of steering gears and their construction, conventional layout of steering linkage. Power and power assisted steering, under steering and over steering effects, four wheel steering, steering of crawler tractors

Suspension: Objectives, types of springs, spring materials, leaf spring, coil spring, torsion bar, rubber & pneumatic suspension, Hydro-elastic suspension, shock absorbers, types of independent suspension.

Module – III

Drive line: Torque reaction, driving thrust, Hotchkiss drive, torque tube drive, propeller shaft, universal joints, types, differential action, constructional details, differential lock, limited slip differential, axle housing types & construction, double reduction and twin speed final drives, multi axle vehicles

Wheels and tyres: Types of wheel, construction of wired wheel, disc wheel, tyre type & construction, aspect ratio, specification of tyres, tyre rotation, static & rolling properties of pneumatic tyres.

Module – IV

Brakes: Types, stopping times & distance, braking efficiency, brake drums and liners, theory of shoe brakes, determination of brake torque, self energizing brakes, determination of brake torque, disc brakes, classification of brakes, Hydraulic brakes, mechanical brakes, servo brakes, power assisted brakes, air brakes, fail safe brakes, exhaust brakes, retarders, layout & details of components. Fundamentals of Antilock Braking System (ABS).

References:

1. Heldt P.M., *Automotive Chassis*, Chillon Book Co., 1952.
2. Newton K., W. Steeds and T. K. Garret, *Motor Vehicle*, Butterworth, 13/e, 2005.
3. Gilles T., *Automotive Chassis - Brakes, Steering and Suspension*, Thomson Delmar Learning, 2005.
4. Narang G. B. S., *Automobile Engineering*, Khanna Publishers, Delhi, 2005.
5. Singh K., *Automotive Engineering Vol. I*, Standard Publishers, Delhi, 2002.
6. Crouse W. H. and D. L. Anglin, *Automotive Mechanics*, McGraw Hill, 10/e, 2000.
7. Banga T. R. and N. Singh, *Automobile Engineering*, Khanna Publishers, Delhi, 1993.
8. Giri N. K., *Automotive Mechanics*, Khanna Publishers, Delhi, 2007.

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:

At the end of the course, the students will be familiar with the fundamentals of Automobile Chassis Components.

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 AUTO CHASSIS LAB (U)

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

Course Objectives:

- *To provide knowledge about Automotive Engine and Chassis components*
- *Make to students to familiar with Disassembling and assembling of various systems in automobiles.*
- *Identify the various components and familiar with repair of the components.*

List of Experiments:

1. Study of hand tools and equipments sketching and its uses. Study of different types of chassis layouts, components and measuring the chassis dimensions.
2. Disassembling of 4 cylinder engine, inspection of components, servicing of components, decarbonising procedure, measurement of dimension of different components of engine, compare with standard specifications, piston ring testing, assembling using special tools.
3. Disassembling cylinder head, servicing of valves, adjusting tappet clearance, testing valve spring tension with spring tester
4. Valve timing & adjustments of fan belt tension.
5. Compression test of petrol and diesel engine.
6. Rectifying the troubles in ignition system, adjusting spark plug and CB Point gap, checking ignition timing.
7. Servicing of Fuel supply system in Petrol engines - Servicing of A.C. Mechanical fuel pump and testing the pump. Servicing of carburetor, carburetor adjustments, tuning of carburetors.
8. Servicing of fuel injection pump, injector, testing of injector
9. Servicing of clutch assembly, checking the spring tension of coil springs in spring tester.
10. Dismantling of gear box, inspecting Components, servicing, checking the gear ratios. Study of Transaxle assembly.
11. Dismantling of differential assembly, servicing, backlash adjustments, check for drive axle ratio.
12. Servicing of steering gear box, checking for end play.
13. Servicing master and wheel cylinders in hydraulic brake system, bleeding of brakes.
14. Servicing of air conditioning unit.

15. Preparing immature models of body structures of cars, jeeps, van and heavy duty vehicles. (By adopting suitable scales prepared by sheet metal work)

Note: *Students should complete at least 11 experiments from the above during the semester*

Internal Continuous Assessment *(Maximum Marks-50)*

20% - Test/s
60% - Class work and Fair 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

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

Course Outcome:

At the end of the course, the students will be familiar with the fundamentals and working principle of various Automobile Chassis Components.

13.306 MACHINES AND AUTO COMPONENT DRAWING (U)

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

Course Objectives:

To enable the engineering students to understand

- *Indian codes and standards for engineering drawing*
- *Representation of Fits and Tolerances in technical drawing*
- *Draw a detailed production and assembly drawing for given components*

Module – I

Technical drawing standards, fits and tolerances: Indian Standard Code of practice for Engineering Drawing: General principles of presentation, conventional representation of threaded parts, gears, springs and common features. Abbreviations and symbols used in technical drawings. Datum and datum features symbols used to represent geometric tolerances. Limits, fits and tolerances-need, types, representation of tolerances on drawing, calculation of minimum and maximum clearances and allowances. Geometric tolerance-uses, types of form and position tolerances, symbols, method of indicating geometric tolerances on part drawings. Surface finish symbols- methods of indicating the surface roughness.

Module – II

Automobile Layouts and Circuit diagrams: Drawing the simple layout of service stations showing the details of departments, equipments and specifications. Drawing the general electrical wiring diagrams of various vehicles like Scooters Motor cycles and LMV. Drawing the wiring diagram of Ignition circuit, charging circuit, Starter circuit, Horn circuit, fuel gauge, oil pressure gauge and temperature gauge circuits

Module – III

Assembly Drawing of Machine Components and Automobile Components: Assembly drawing of Flanged coupling and universal coupling, Spring loaded safety valve – Non return valve, Diaphragm valve, Air valve, piston assembly, connecting rod, fuel injector, master cylinder, wheel cylinder, Rotator gear pump, Clutches, Differential assembly, S.U. Carburetor.

References :

1. Bhatt N. D., V. M. Panchal, *Machine Drawing*, Charotar Publishing House, 2000.
2. Junarkar N. D., *Machine Drawing*, Pearson Education, 2007.

3. Gupta R. B., *Automobile Engineering Drawing*, Satya Prakashan, New Delhi, 2011.
4. Narayana K. L., P. Kanniah and K. V. Reddy, *Machine Drawing*, New Age International Ltd., New Delhi. 2010.
5. Gopalakrisima K. R., *Machine Drawing*, Subhash Publications, Bangalore, 2003.
6. Weston E B, *Automobile Engineering Drawing for Technical Student*, Chilton/Haynes, 1966.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (At least 10 sheets covering the syllabus).

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) - Four questions from Module I and II of 10 marks each. All questions are compulsory. There should be two questions from each module.

Part B (60 Marks) - Candidates have to answer one full question (Assembly drawing of Machine / Automobile Components) out of the two from module III. Each question carries 60 marks.

Course Outcome:

At the end of the course, the students will be familiar with the detailed Component and assembly drawing along with standards of technical drawing.

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 , *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 HEAT ENGINES LAB (U)

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

Course Objectives:

- *To strengthen the knowledge on heat engines and their performance testing by dynamometers.*
- *To make the students understand the testing of fuels and lubricants with appropriate equipments.*
- *To equip the students to carry out independent experiments, and to train them to analyse, report and infer the results.*

List of Experiments :

1. Temperature dependence of viscosity of lubrication oil by Redwood viscometer.
2. Viscosity index of lubricating oil by Say bolt viscometer
3. Flash and fire points of fuels and lubricants.
4. ASTM distillation test of gasoline
5. Determination of calorific values of liquid and gaseous fuels.
6. Study of different types of dynamometers.
7. Testing of LC, Engines- Measurement of Brake Power using different types of dynamometer- mechanical, hydraulic, electric. Measurement of indicated power, mechanical efficiency, thermal efficiency, volumetric efficiency and SFC- for both petrol and diesel engines.
8. Morse test on engines.
9. To prepare beat balance sheet for I.C. Engines.
10. Drawing valve timing diagram,
11. Study of effect of Air fuel ratio, ignition timing on power, torque, SFC and efficiencies of engines.
12. Testing of Engines with different fuels with variable compression ratio – Measurement of mechanical efficiency, thermal efficiency, and SFC and comparision.
13. Test on air conditioning unit- determination of input, adiabatic efficiency, Isothermal efficiency and volumetric efficiency.
14. Test on heat Exchanger

Note: *Students should complete at least 10 experiments from the above during the semester*

Internal Continuous Assessment *(Maximum Marks-50)*

20% - Test/s

60% - Class work and Fair 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

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

Course Outcome:

At the end of the course, the students will be familiar with the testing of IC Engines, fuels and lubricants.