UNIVERSITY OF KERALA

B. TECH. DEGREE COURSE

(2013 SCHEME)

SYLLABUS FOR

IV SEMESTER

MECHANICAL - STREAM - AUTOMOBILE ENGINEERING

SCHEME -2013

IV 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				
13.401	Engineering Mathematics -III (BCHMNPSU)	4	3	1	-	50	3	100	150
13.402	Computer Programming and Numerical Methods (U)	4	3	1	-	50	3	100	150
13.403	Auto Power Plant (U)	4	3	1	-	50	3	100	150
13.404	Metallurgy and Material Science (MNPU)	4	3	1	-	50	3	100	150
13.405	Production Process / Manufacturing Technology (U)	4	3	1	-	50	3	100	150
13.406	Fluid Mechanics and Hydraulic Machines (U)	4	3	1	-	50	3	100	150
13.407	Mechanics of Solids Lab (U)	2	-	-	2	50	3	100	150
13.408	Machine Shop I (U)	3	-	-	3	50	3	100	150
	Total	**29**	**18**	**6**	**5**	**400**		**800**	**1200**

13.401 ENGINEERING MATHEMATICS - III (BCHMNPSU)

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

Course Objective:

- *To introduce the basic notion in complex analysis such as Analytic Functions, Harmonic functions and their applications in fluid mechanics and differentiations and integration of complex functions, transformations and their applications in engineering fields.*
- *Numerical techniques for solving differential equations are also introduced as a part of this course.*

Module – I

Complex Differentiation: Limits, continuity and differentiation of complex functions. Analytic functions – Cauchy Riemann equations in Cartesian form (proof of necessary part only).Properties of analytic functions – harmonic functions. Milne Thomson method.

Conformal mapping: Conformality and properties of the transformations $w = \frac{1}{z}$, $w = z^2$, $w = z + \frac{1}{z}$, $w = \sin z$, $w = e^z$ - Bilinear transformations.

Module – II

Complex Integration: Line integral – Cauchy's integral theorem – Cauchy's integral formula – Taylor's and Laurent's series – zeros and singularities – residues and residue theorem.

Evaluation of real definite integrals – $\int_0^{2\pi} f(sinx, cosx)dx$, $\int_{-\infty}^{\infty} f(x)dx$ (with no poles on the real axis). (Proof of theorems not required).

Module – III

Numerical techniques-Solutions of algebraic and transcendental equations-Bisection method – Regula-falsi method – Newton - Raphson method. Solution of system of equations - Gauss elimination, Gauss- Siedel iteration. Interpolation – Newton's Forward and backward formulae - Lagrange's interpolation formula.

Module – IV

Numerical integration-Trapezoidal Rule- Simpson's one third rule.

Numerical solution of ODE –Taylor's series method - Euler's method - Modified Euler's method – Runge-Kutta method of order Four.

Numerical Solution of two-dimensional partial differential equation (Laplace equation)-using finite difference method (five point formula)

References:

1. Bali N. P. and M. Goyal, *Engineering Mathematics*, 7/e, Laxmi Publications, India, 2012.
2. Kreyszig E., *Advanced Engineering Mathematics*, 9/e, Wiley India, 2013.
3. Grewal B. S., *Higher Engineering Mathematics*, 13/e, Khanna Publications, 2012.
4. Koneru S. R., *Engineering Mathematics*, 2/e, Universities Press (India) Pvt. Ltd., 2012.
5. Sastry S. S., *Introductory Methods of Numerical Analysis*, 5/e, PHI Learning, 2012.
6. Babu Ram, *Numerical Methods*, 1/e, Pearson Education, 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) - 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:

After successful completion of this course, the students will be able to use numerical methods to solve problems related to engineering fields. This course helps students to master the basic concepts of complex analysis which they can use later in their career.

13.402 COMPUTER PROGRAMMING & NUMERICAL METHODS (U)

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

Course Objectives:

- *To learn the basic concepts of computing,*
- *To know the methodology of problem solving.*
- *To impart knowledge to analyze, solve, design and code real life problems using C and C++languages.*

Module – I

Introduction to Computer programming concept - Algorithm and flow chart, Basics of procedure oriented and object oriented programming. Introduction to C++: Structure of C++ program; Key words; Identifiers; Data types – integer, real, character, string, boolean, enumeration, array and pointer; Constant and Variables; Escape sequences; Operators – assignment, arithmetic, relational, logical, increment & decrement, conditional, sizeof, comma and bitwise operators.

Module – II

Statements – simple & compound, declaration statements, Control statements -if, if-else, switch, for loop, while, do-while, break and continue statements, Input and output streams, .Arrays – one dimensional & two dimensional; Functions- inline functions, function over loading, Functions with default arguments, recursion, pointers. Simple programs using above features.

Module – III

Introduction to Class and Object- definition, data members, member function, private & public member function, member access, friend declaration, class objects, predefined classes, initialization, constructor and destructor; Operator overloading, Inheritance- base class and derived class; Input/output stream libray - ifstream, ofstream , fstream, class flies. Simple problems using the above features.

Module – IV

Errors and approximations – floating point arithmetic – sources of errors – control of errors – propagation of errors – condition and stability – Rate of convergence. Interpolation – Newton's Divided difference, Lagrange, Aitken, Hermite and Spline techniques- Inverse interpolation. Curve fitting – method of least squares – non-linear relationships – Correlation and Regression – Linear correlation – measures of correlation – Standard error of estimate – coefficient of correlation. Solution of Partial differential equations –

classification – Laplace equation – Finite difference methods – relaxation methods. Stability and convergence of solution. Numerical problems and preparation of computer programs for the above methods.

References

1. Kamthane A. M., *Object oriented Programming with ANSI & Turbo C++*, 3/e, Pearson Education, 2005.
2. NaglerE*., Learning C++, A Hands on Approach*, Jaico Publications, 1994.
3. Lippman S. B., J. Lajoie and B. E. Moo, *C++ Primer*, Pearson Education, 2012.
4. Balagurusamy E., *Object Oriented Programming with C++*, McGraw Hill, 2013.
5. Barkakati N*., Object Oriented Programming in C++* , SAMS Publishing, 1991.
6. Balagurusamy E., *Numerical Methods*, Tata McGraw Hill, 1999.
7. Gerald C. F. and P. O. Wheatley, *Applied Numerical Analysis*, Pearson Education, 2006.

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) - 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:

The students will be familiar with methodology of problem solving and develop programs to solve problems.

13.403 AUTO POWER PLANT (U)

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

Course Objectives:

To Know the Construction and Working principle of

- *Engine components*
- *Cooling and lubrication system components*
- *Fuel supply system of Petrol and Diesel Engines*

Module – I

Introduction: Types of power plant, Basic engine nomenclature, classification of IC engines (Classification by cylinder arrangement, Valve arrangement and Type of valves), Engine cycles, Comparison of SI and CI engines, working of 2 -stroke and 4 stroke engines with relative merits and demerits, Numbering of cylinders, firing order.

Constructional details of engine components: Moving parts and stationary parts, engine block, Cylinder block and crank case - types, cylinder liners, types of cylinder head, gasket materials, piston types, piston rings, piston pins, connecting rod, crank shaft, flywheel, vibration damper, Main Bearings, camshaft, camshaft drives, Types of valve and valve seats, valve actuating mechanisms (mechanisms with side camshaft and overhead camshaft), inlet and exhaust manifold construction, hydraulic tappets.

Module – II

Fuel supply system in petrol engines: Types of fuel feed systems, fuel tank, fuel pumps and fuel filters (types and construction), air filter types and construction, combustion and ignition limits in SI engines, carburetion, properties of air-petrol mixtures, mixture requirements for steady state operation, transient mixture requirements, simple carburetor, different circuits in carburetor, type of carburetors like Solex, SU, Carter etc, MPFI engines, GDI engines, Flex fuel engines.

Module – III

Fuel supply system in diesel engines: Requirements of diesel injection system, Components of diesel injection system, Diesel filters, fuel feed pump, hand pump, heavy duty air filters, Diesel injection pump types - simple and multiple unit pump, C-AV Bosch pump, Modem distributor type pumps, CRDI, injection nozzles and types of injectors, governors (mechanical, pneumatic and hydraulic governors), cold starting devices.

Module – IV

Cooling system: Necessity of engine cooling and correct operating temperatures, types of cooling systems like Direct air cooling, Indirect or water cooling, Liquid cooling, Pressure sealed cooling, Evaporative cooling or steam cooling, components of water cooling system

(thermostat, water pump, radiator, cooling fan etc), antifreeze solution, temperature gauges.

Lubrication system: Function of lubrication system, lubrication principles, classification of lubricants, types of lubricants, properties of lubricants, service ratings of oils, oil additives, specification of lubricants, crankcase ventilation, lubrication systems (Mist, Wet sump Dry sump lubrication systems), pre-lubrication systems, effect of engine conditions on lubricating oil, consumption of lubricating oil, Components of lubrication system (oil strainers, oil filters, oil pumps, oil coolers), chassis lubrication.

References:

1. Garrett T. K., K. Newton and W. Steeds, *The Motor Vehicle*, Butterworth-Heinemann, 2001.
2. K. Singh, *Automobile Engineering* – Vol. I & II, Standard Publications, 2011.
3. Heitner J., *Automotive Mechanics: Principles and Practices*, CBS Publishers, 2004.
4. Banga T. R. and N. Singh, *Automobile Engineering*, Khanna Publishers, 1993.
5. Judge A.W., *Modem Petrol Engine*, Chapman and Hall, London, 1965.
6. Heldt P. M., *High Speed Diesel Engines*, Chilton Co., Philadelphia, 1953.
7. Crouse W. H. and D. L. Anglin, *Automotive Mechanics*, 3/e, Tata McGraw Hill, 1985.

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 students would be familiar with various components of Automobile Engines along with Auxiliary systems.

13.404 METALLURGY AND MATERIAL SCIENCE (MNPU)

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

Course Objective:

To impart knowledge on engineering materials, deformation of materials, equilibrium diagrams of selected alloy systems, heat treatment of steels, properties of steels, cast iron and other alloys and their applications.

Module – I

Introduction to material science and engineering, Classification of engineering materials, Crystal structure of metallic materials. Imperfections in crystals: point defects, line defects, surface defects.

Mechanical behaviour of materials: Elastic, visco elastic, anelastic behaviour.

Mechanisms of plastic deformation: role of dislocation, slip and twinning; Schmid's law. Strengthening mechanisms: Grain size reduction, solid solution strengthening, work hardening, Precipitation hardening. Recovery, recrystallisation and grain growth.

Specimen preparation for microstructural examination: Etching. Grain size determination by comparison with standard chart, Hall-Petch equation.

Module – II

Fracture: ductile fracture, brittle fracture, Griffith's theory of brittle fracture, ductile to brittle transition , fracture toughness.

Fatigue: mechanism of fatigue, S-N curve. Creep: creep curve, mechanism of creep.

Diffusion: Fick's laws of diffusion, Mechanisms of diffusion, applications. Solidification of metals and alloys. Solid solution, Hume Rothery's rules.

Phase diagrams: Phase rule, Lever Rule, Relationship between micro structure and properties, Isomorphous systems: Cu-Ni phase diagram, Eutectic systems: Pb-Sn phase diagram. Eutectoid and peritectic reactions.

Module – III

Iron- Carbon equilibrium diagram Development of microstructure in Iron Carbon alloys, Phase transformations in steel. Detailed discussion on Iron-Iron Carbide phase diagram with reference to micro constituents like austenite, ferrite, cementite, pearlite and ledeburite.

TTT diagram for eutectoid steel, CCT diagram, critical cooling rate. Transformation of austenite to pearlite, bainite, martensite spheroidite etc.

Heat treatment of steel: Annealing, normalizing, hardening, tempering, austempering, martempering, Hardenability, Jominy end quench test. Surface treatments: Case Hardening, Carburising, Nitriding, Cyaniding, CVD, PVD, Thermal spraying.

Module – IV

Applications of ferrous and non ferrous alloys: Steel- low, medium, high carbon steels, Alloy steels: effect of various alloying elements in steel.

Stainless steels -ferritic, austenitic, martensitic, duplex steels. Tool steels. Cast iron- gray, white, ductile cast irons. Copper and its alloys. Aluminium and its alloys, Magnesium and alloys, Titanium and its alloys.

Composite materials for mechanical engg applications: classification, fabrication methods: stir casting, powder metallurgy and filament winding. Introduction to Smart materials, Nano materials, Bio materials, Bioplastics. Selection of materials based on properties, service, economic and environmental considerations.

References:

1. Callister W. D. and D. G. Rethwisch, *Material Science and Engineering*, 8/e, John & Wiley Sons, 2010.
2. Raghavan V., *Material Science and Engineering*, PHI Learning Pvt. Ltd., 2004.
3. Jose S. and Mathew E. V., *Metallurgy and Materials Science,* Pentagon Educational Services, 2011.
4. Shackelford J., *Introduction to Materials Science for Engineers*, 7/e, Pearson, 2009.
5. Van Vlack L. H., *Elements of Materials Science and Engineering*, Addison-Wesley, 1989.
6. Lakhtin Y., *Engineering Physical Metallurgy*, Gordon and Breach Science Publishers, 1965.
7. Dieter G. E., *Mechanical Metallurgy*, McGraw-Hill, 1976.
8. Reed-Hill R. E., *Physical Metallurgy*, PWS-Kent Publishing Company, 1992.
9. Avner S. H*., Introduction to Physical Metallurgy*, McGraw-Hill, 1974.

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 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 successful completion of the course, the students will possess knowledge on:

- *The property classifications of materials that determine their applicability.*
- *The mechanisms of elastic and plastic deformations and thereby be able to modify the mechanical properties of materials.*
- *Heat treatment processes and how to select suitable heat treatments for specific applications.*
- *Different failure mechanisms and thereby how to decide steps to avoid failures.*
- *Different alloy systems and their applications, so that proper selection of material can be made.*
- *Newer engineering materials like Composites, smart materials, nanomaterials.*

13.405 PRODUCTION PROCESS / MANUFACTURING TECHNOLOGY (U)

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

Course Objectives:

- *To know the construction of lathe, milling, drilling, shaping and milling machines.*
- *To familiarize with the concept of Machining with lathes, milling drilling, shaping and planning machines.*
- *To study Various Surface finishing and Surface hardening processes.*

Module – I

Lathe and its operations: Description of typical types of lathe, lathe parts, lathe accessories, taper turning - different methods of taper turning calculations, taper turning attachments. Capston and Turret Lathes: Description of types of turret lathes, tool holders etc.

Module – II

Drilling: Types of drilling machines, operations performed, tool and work holding devices, description of pneumatic drilling machines, vertical boring machines, Jig borer, Jig grinders.

Shaping and Planing machines: Principle of crank shaper, hydraulic shaper, shaper tools etc. Planer: principle, description of planer, feed mechanism, etc.

Module – III

Milling machines: Description of typical types of milling machines, milling cutters, different operations, indexing etc.

Grinding wheels & grinding operations: Selection of wheels, speed, feed etc., wheel dressing, balancing, standard marking system, Types of grinding operations, grinding machinery etc.

Module – IV

Broaching: Operation, principle, broaching cutters, types of broaching machines etc.

Finishing operations: Lapping, honing, super finishing, etc.

N. C. Machines: Concept and working of N.C. Machines.

References:

1. Kalpakijan S., *Manufacturing Engineering and Technology*, Addison & Wesley, 1992.
2. Ramaswamy M. and P. Kumar*, Fundamentals of Design and Manufacturing*, S.K. Kataria & Sons, 2007.

3. Chitale A. K. and R. C. Gupta, *Product Design and Manufacturing*, 3/e, Prentice Hall, 2005.
4. Jain R. K., *Production Technology*, Khanna Publishers, 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) - 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 student will be familiar with all types machining process and their applications in industry.

13.406 FLUID MECHANICS AND HYDRAULIC MACHINES (U)

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

Course Objective:

- *To understand the structure and the properties of the fluid.*
- *To understand and appreciate the complexities involved in solving the fluid flow problems.*
- *To understand the mathematical techniques already in vogue and apply them to the solutions of practical flow problems.*
- *To understand the energy exchange process in fluid mechanics handling incompressible fluids.*

Module – I

Introduction And Basic Concepts To Fluid Mechanics: Classification of fluids. Properties of fluids: viscosity, Newton's laws of viscosity, surface tension, capillarity etc. Properties of fluids, pressure measurement, - density, specific weight, specific volume, specific gravity, temperature, viscosity, compressibility, vapour pressure, capillary and surface tension.

Fluid Statics- Concept of fluid static pressure, absolute and gauge pressures - pressure measurements by manometers and pressure gauges. Hydrostatic law, Total pressure and Centre of pressure for Plane and curved surfaces, Buoyancy and stability of floating bodies, metacentric height

Module – II

Fluid Dynamics: Laws of kinematics of fluid flow. Lagrangian and Eulerian method. Convective and local acceleration, Stream line, Streak line and path line, concept of circulation and vorticity, Continuity equation in differential form, Stream function and potential functions with inter relations, concept of flow nets.

Energy equations: Bernoulli's equations and its applications in pitot static tube, venturimeter, and orifice meter, energy correction factor, Momentum equation, Applications of momentum equations in pipe bends, impact of jets on moving and stationary ,plane and curved vanes, moment of momentum equations, force exerted on a series of radial curved vanes.

Module – III

Dimensional Analysis: Buckingham's theorem, Non-dimensional numbers, similarities of flow. Model studies.

Laminar and Turbulent Flows: Reynolds experiments. Shear stress and velocity distribution for viscous flow through circular pipes and flat plates, Hagen Poiseullie's equation, concept of boundary layer theory and separation of fluid flow, causes of turbulence, Characteristics of turbulent flow.

Flow through pipes: major and minor energy losses in pipes, pipes in series and parallel, equivalent cavitation, water hammer.

Module – IV

Hydraulic Machinery: Fluid machines, definition and classification - Hydro turbines: definition and classifications - Pelton turbine - Francis turbine - propeller turbine - Kaplan turbine - working principles - velocity triangles - work done - specific speed - efficiencies - performance curve for turbines.

Pumps: definition and classifications - Centrifugal pump: classifications, working principles, efficiency and performance curves - Reciprocating pump: classification, working principles, indicator diagram, work saved by air vessels and performance curves - cavitations in pumps. Rotary pumps: working principles of gear and vane pumps.

References:-

1. Streeter, V.L. and E.B. Wylie, *Fluid Mechanics*, McGraw-Hill, 1998.
2. Varanasi, V.P., *Hydraulic Machines - Theory and Design*, Khanna Publishers, 1992.
3. Bansal R. K., *A Textbook of Fluid Mechanics and Hydraulic Machines*, Laxmi Publications, 2005.
4. Ramamirtham S., *Fluid Mechanics and Hydraulics and Fluid Machines*, Dhanpat Rai and Sons, Delhi, 1998.
5. Som, S. K., and G. Biswas, *Introduction to Fluid Mechanics and Fluid Machines*, 2/e, Tata McGraw- Hill, 2003.
6. Cengel Y. A. and J. M. Cimbala*, Fluid Mechanics*, Tata McGraw Hill, 2013.
7. Kumar D. S., *Fluid Mechanics and Fluid Power Engineering*, S. K. Kataria and Sons, New Delhi, 1997.
8. White F. M., *Fluid Mechanics*, 5/e, McGraw Hill, 2005.

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, student will be familiar with the structure and properties of the fluid, fluid flow complexities and construction, working and applications of hydraulic machines.

13.407 MECHANICS OF SOLIDS LAB (U)

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

Course Objective :

- *To provide knowledge on the mechanical behaviour of materials.*
- *To acquaint with the experimental methods to determine the mechanical properties of materials*

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

Note: *Students should complete at least 8 experiments*

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*

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

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

Graphs, Results and inference (15%)

25% - Viva voce

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

Course Outcome:

At the end of this course the students will be familiar with the testing of materials to determine the various mechanical properties.

13.408 MACHINE SHOP - I (U)

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

Course Objective :

- *To acquaint with the basic operations of lathe, shaping, slotting and planning machines.*
- *To conduct the exercise involving plane turning, groove cutting, taper turning, facing and thread cutting operations.*

List of Exercises:

1. General study of Lathe and Accessories, Tools used for different operations. Exercises involving plane turning, Groove cutting, form turning, taper turning, facing and thread cutting.
2. Study of shaping and slotting machines, and planning machines, exercises involving production of flat surfaces, grooves and key ways.

Note: *Students should complete at least 8 models as per the above exercises during the semester*

Internal Continuous Assessment *(Maximum Marks-50)*

20% - Test
60% - 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 exercises prescribed.

75% - Procedure, Conducting exercise (Working), Results, Tabulation and Inference.

25% - 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 various operations using lathe, shaping, slotting and planning machines.