MATERIAL SCIENCE AND METALLURGY

[AS PER CHOICE ASED CREDIT SYSTEM (CBCS) SCHEME]

SEMESTER – III

Subject Code	15 MR32	IA Marks	20
Number of Lecture Hrs / Week	04	Exam Marks	80
Total Number of Lecture Hrs	50	Exam Hours	03
CREDITS – 04			

COURSE OBJECTIVES:

This course provides

1. The foundation for understanding the structure and various modes of failure in materials common in mechanical engineering.
2. Topics are designed to explore the mechanical properties of metals and their alloys and composites.
3. The means of modifying such properties, as well as the processing and failure of materials.
4. Concepts of use of materials for various applications are highlighted.

COURSE OUTCOMES:

The student shall be able to

1. Describe the mechanical properties of metals, their alloys and various modes of failure.
2. Understand the microstructures of ferrous and non-ferrous materials to mechanical properties.
3. Explain the processes of heat treatment of various alloys.
4. Understand the properties and potentialities of various materials available and material selection procedures.
5. Know about composite materials and their processing as well as applications.

MODULE 1

Basics, Mechanical Behavior, Failure of Materials

Introduction to Crystal Structure – Coordination number, atomic packing factor, Simple Cubic, BCC, FCC and HCP Structures, Crystal imperfections – point, line, surface and volume imperfections, Atomic Diffusion: Phenomenon, Fick's laws of diffusion;Factors affecting diffusion.

Mechanical Behavior:

Stress-strain diagram for ductile and brittle materials, mechanical properties in plastic range, yield strength offset yield strength, ductility, ultimate tensile strength, toughness.

toughness

10 Hours

MODULE 2

Plastic deformation: of single crystal by slip and twinning.

Fracture: Type I, Type II and Type III,

Fatigue: Types of fatigue loading with examples, Mechanism of fatigue, Fatigue properties, S-N diagram, Fatigue testing.

Creep: Description of the phenomenon with examples, three stages of creep, creep properties, Stress relaxation.

10 Hours

MODULE 3

Solidification

Mechanism of solidification, Homogenous and Heterogeneous nucleation, crystal growth, cast metal structures. **Phase Diagram I:** Solid solutions Hume Rothary rule substitutional, and interstitial solid solutions, intermediate phases, Gibbs phase rule.

Phase Diagram II

Construction of equilibrium diagrams involving complete and partial solubility, lever rule. Different types invariant reactions – Eutectic, Eutectoid, Peritectic, Peritectectoid reactions etc.

10 Hours

MODULE 4

Iron carbon equilibrium diagram

Description of phases, solidification of steels and cast irons, invariant reactions.

Heat treating of metals

TTT curves, continuous cooling curves, description of the following heat treatmen processes with industrial applications: annealing and its types. normalizing, hardening, tempering, martempering, austempering, hardenability, surface hardening methods like carburizing, cyaniding, nitriding, flame hardening and induction hardening, age hardening of aluminum-copper alloys. **10 Hours**

MODULE 5

Ferrous and non ferrous materials

Properties, Composition and uses of Grey cast iron, malleable iron, SG iron and steel Copper alloys-brasses and bronzes. Aluminum alloys-Al-Cu, Al-Si, Al-Zn alloys. Titanium alloys

Composite Materials

Definition, classification, types of matrix materials & reinforcements, fundamentals of production of FRP's and MMC's advantages and application of composites.

10 Hours

TEXT BOOKS:

1. Smith, Foundations of Materials Science and Engineering, 4th Edition, McGraw Hill, 2009.
2. William D. Callister, Material science and Engineering and Introduction, Wiley, 2006.

REFERENCE BOOKS

1. V.Raghavan, Materials Science and Engineering, , PHI, 2002
2. Donald R. Askland and Pradeep.P. Phule, The Science and Engineering of Materials, Cengage Learning, 4lh Ed., 2003.
3. George Ellwood Dieter, Mechanical Metallurgy, McGraw-Hill.
4. ASM Handbooks, American Society of Metals.

Scheme of Examination:

Two question to be set from each module. Students have to answer five full questions, choosing at least one full question from each module.

BASIC THERMODYNAMICS

[AS PER CHOICE ASED CREDIT SYSTEM (CBCS) SCHEME]

SEMESTER – III

Subject Code	15 MR33	IA Marks	20
Number of Lecture Hrs / Week	04	Exam Marks	80
Total Number of Lecture Hrs	50	Exam Hours	03
CREDITS – 04			

COURSE OBJECTIVES

1. Learn about thermodynamic systems and boundaries
2. Study the basic laws of thermodynamics including, conservation of mass, conservation of energy or first law , second law and Zeroth law.
3. Understand various forms of energy including heat transfer and work
4. Identify various types of properties (e.g., extensive and intensive properties)
5. Use tables, equations, and charts, in evaluation of thermodynamic properties
6. Apply conservation of mass, first law, and second law in thermodynamic analysis of systems (e.g., turbines, pumps, compressors, heat exchangers, etc.)
7. Enhance their problem solving skills in thermal engineering

COURSE OUTCOMES

The student will be able to

	Course Outcomes	PO's	Course Level
CO 1	Explain thermodynamic systems, properties, Zeroth law of thermodynamics, temperature scales and energy interactions.	PO1	U
CO 2	Determine heat, work, internal energy, enthalpy for flow & non flow process using First and Second Law of Thermodynamics.	P01, PO2	Ap
CO3	Interpret behavior of pure substances and its applications to practical problems.	PO1,PO2	U
CO4	Determine change in internal energy, change in enthalpy and change in entropy using TD relations for ideal gases.	PO1,PO2	Ap
CO 5	Calculate Thermodynamics properties of real gases at all ranges of pressure, temperatures using modified equation of state including Vander Waals equation, Redlich Wong equation and Beattie-Bridgeman equation.	PO1,PO2	Ap
Total Number Lecture hours		**50**	

MODULE 1

Fundamental Concepts & Definitions: Thermodynamic definition and scope, Microscopic and Macroscopic approaches. Some practical applications of engineering thermodynamic Systems, Characteristics of system boundary and control surface, examples. Thermodynamic properties; definition and units, intensive , extensive properties, specific properties, pressure, specific volume Thermodynamic state, state point, state diagram, path and process, quasi-static process, cyclic and non-cyclic; processes;Thermodynamic equilibrium; definition, mechanical equilibrium; diathermic wall, thermal equilibrium, chemical equilibrium, Zeroth law of thermodynamics, Temperature; concepts, scales, international fixed points and measurement of temperature. Constant volume gas thermometer, constant pressure gas thermometer, mercury in glass thermometer

Work and Heat: Mechanics, definition of work and its limitations. Thermodynamic definition of work; examples, sign convention. Displacement work; as a part of a system boundary, as a whole of a system boundary, expressions for displacement work in various processes through p-v diagrams. Shaft work; Electrical work.Other types of work.Heat; definition, units and sign convention. Problems **10 Hours**

MODULE 2

First Law of Thermodynamics: Joules experiments, equivalence of heat and work. Statement of the First law of thermodynamics, extension of the First law to non - cyclic processes, energy, energy as a property, modes of energy, Extension of the First law to control volume; steady flow energy equation(SFEE), important applications.

Second Law of Thermodynamics: limitations of first law of thermodynamics Devices converting heat to work; (a) in a thermodynamic cycle, (b) in a mechanical cycle. Thermal reservoir,Direct heat engine; schematic representation and efficiency. Devices converting work to heat in a thermodynamic cycle; reversed heat engine, schematic representation, coefficients of performance. Kelvin - Planck statement of the Second law of Thermodynamics; PMM I and PMM II, Clausius statement of Second law of Thermodynamics, Equivalence of the two statements; Carnot cycle, Carnot principles. Problems **10 Hours**

MODULE 3

Entropy: Clasius inequality; Statement, proof, application to a reversible cycle. Entropy; definition, a property, change of entropy, principle of increase in entropy, entropy as a quantitative test for irreversibility, calculation of entropy using Tds relations, entropy as a coordinate, numerical problems. Available and unavailable energy. Reversible work and irreversibility, (no numerical problems)

Pure Substances

P-T and P-V diagrams, triple point and critical points. Subcooled liquid, saturated liquid, mixture of saturated liquid and vapour, saturated vapour and superheated vapour states of pure substance with water as example. Enthalpy of change of phase (Latent heat). Dryness fraction (quality),T-S and H-S diagrams, representation of various processes on these diagrams. Steam tables and its use. Throttling calorimeter, separating and throttling calorimeter

10 Hours

MODULE 4

Thermodynamic relations

Helmholtz and Gibbs functions, .Maxwell relation, Clausius Clayperon's equation .Ideal gas; equation of state, internal energy and enthalpy as functions of temperature only, universal and particular gas constants, specific heats, perfect and semi-perfect gases. Evaluation of heat, work, change in internal energy .enthalpy and entropy in various quasi-static processes

10 Hours

MODULE 5

Ideal gas mixture

Ideal gas mixture; Dalton's laws of partial pressures, Amagat's law of additive volumes, evaluation of properties, Analysis of various processes. Real Gases: Introduction. Van-der Waal's Equation of state, Van-der Waal's constants in terms of critical properties, Law of corresponding states, compressibility factor; compressibility chart, Redllich Kwong equation ,Beattie-bridgeman equation

10 Hours

TEXT BOOKS:

1. Basic Engineering Thermodynamics, A.Venkatesh, Universities Press, 2008
2. Basic and Applied Thermodynamics, P.K.Nag, 2nd Ed., Tata McGraw Hill Pub. 2002

REFERENCE BOOKS:

1. Thermodynamics, An Engineering Approach, YunusA.Cenegal and Michael A.Boles, Tata McGraw Hill publications, 2002
2. Engineering Thermodynamics, J.B.Jones and G.A.Hawkins, John Wiley and Sons..
3. Fundamentals of Classical Thermodynamics, G.J.VanWylen and R.E.Sonntag, Wiley Eastern.
4. An Introduction to Thermodynamcis, Y.V.C.Rao, Wiley Eastern, 1993,
5. B.K Venkanna, Swati B. Wadavadagi “Basic Thermodynamics, PHI, New Delhi, 2010

Scheme of Examination: Two question to be set from each module. Students have to answer five full questions, choosing at least one full question from each module.

MECHANICS OF MATERIALS

[AS PER CHOICE ASED CREDIT SYSTEM (CBCS) SCHEME]

SEMESTER – III

Subject Code	15 MR 34	IA Marks	20
Number of Lecture Hrs / Week	04	Exam Marks	80
Total Number of Lecture Hrs	50	Exam Hours	03
CREDITS – 04			

COURSE OBJECTIVES:

1. Classify the stresses into various categories and define elastic properties of materials and compute stress and strain intensities caused by applied loads in simple and compound sections and temperature changes.
2. Derive the equations for principal stress and maximum in-plane shear stress and calculate their magnitude and direction. Draw Mohr circle for plane stress system and interpret this circle.
3. Determine the shear force, bending moment and draw shear force and bending moment diagrams, describe behavior of beams under lateral loads.
4. Explain the structural behavior of members subjected to torque, Calculate twist and stress induced in shafts subjected to bending and torsion.
5. Understand the concept of stability and derive crippling loads for columns.
6. Understand the concept of strain energy and compute strain energy for applied loads.

COURSE OUTCOMES:

The student shall be able to

	Course Outcomes	POs	CL
CO1	Understand simple, compound, thermal stresses and strains their relations, Poisson's ratio, Hooke's law, mechanical properties including elastic constants and their relations	PO1	U
CO2	Determine stresses, strains and deformations in bars with varying circular and rectangular cross-sections subjected to normal and temperature loads	PO1,	Ap
CO3	Determine plane stress, principal stress, maximum shear stress and their orientations using analytical method and Mohr's circle	PO1,	Ap
CO4	Determine the dimensions of structural members including beams, bars and rods using Energy methods and also stress distribution in thick and thin cylinders	PO1,	Ap
CO5	Draw SFD and BMD for different beams including cantilever beams, simply supported beams and overhanging beams subjected to UDL, UVL, Point loads and couples	PO1,	Ap
CO6	Determine dimensions, bending stress, shear stress and its distribution in beams of circular, rectangular, symmetrical I and T sections subjected to point loads and UDL	PO1,	Ap
CO7	Determine slopes and deflections at various points on beams subjected to UDL, UVL, Point loads and couples	PO1,	Ap
CO8	Determine the dimensions of shafts based on torsional strength, rigidity and flexibility and also elastic stability of columns using Rankin's and Euler's theory	PO1,	Ap
	Total Hours of instruction	**50**	

MODULE 1

Stress and Strain: Introduction, Hooke's law, Calculation of stresses in straight, Stepped and tapered sections, Composite sections, Stresses due to temperature change, Shear stress and strain, Lateral strain and Poisson's ratio, Generalized Hooke's law, Bulk modulus, Relationship between elastic constants. 10 Hours

MODULE 2

Analysis of Stress and Strain: Plane stress, Stresses on inclined planes, Principal stresses and maximum shear stress, Principal angles, Shear stresses on principal planes, Maximum shear tress, Mohr circle for plane stress conditions.

Cylinders: Thin cylinder: Hoop's stress, maximum shear stress, circumferential and longitudinal strains, Thick cylinders: Lames equations. 10 Hours

MODULE 3

Shear Forces and Bending Moments: Type of beams, Loads and reactions, Relationship between loads, shear forces and bending moments, Shear force and bending moments of cantilever beams, Pin support and roller supported beams subjected to concentrated loads and uniformly distributed constant / varying loads.

10 Hours

MODULE 4

Stress in Beams: Pure bending, Curvature of a beam, Longitudinal strains in beams, Normal stresses in Beams with rectangular, circular, 'I' and 'T' cross sections, Flexure Formula, Bending Stresses, Governing differential equation and its solution

deflection of beams: Double integration method for cantilever and simply supported beams for point load, UDL, UVL and Couple, Macaulay's method, Numerical examples

10 Hours

MODULE 5

Torsion: Circular solid and hallow shafts, Torsional moment of resistance, Power transmission of straight and stepped shafts, Twist in shaft sections, Thin tubular sections, Thin walled sections

Columns: Buckling and stability, Critical load, Columns with pinned ends, Columns with other support conditions, Effective length of columns, Secant formula for columns.

10 Hours

TEXT BOOKS:

1. James M Gere, Barry J Goodno, Strength of Materials, Indian Edition, Cengage Learning, 2009.
2. R Subramanian, Strength of Materials, Oxford, 2005.

REFERENCE BOOKS:

1. S S Rattan, Strength of Materials, Second Edition, McGraw Hill, 2011.
2. Ferdinand Beer and Russell Johston, Mechanics of materials, Tata McGraw Hill, 2003.

Scheme of Examination:

Two question to be set from each module. Students have to answer five full questions, choosing at least one full question from each module.

ELEMENTARY NAVIGATION AND SEAMANSHIP AND SURVIVAL AT SEA

[AS PER CHOICE ASED CREDIT SYSTEM (CBCS) SCHEME]

SEMESTER – III

Subject Code	15 MR 35	IA Marks	20
Number of Lecture Hrs / Week	04	Exam Marks	80
Total Number of Lecture Hrs	50	Exam Hours	03
CREDITS – 04			

COURSE OBJECTIVE

- To provide detailed information of general ship knowledge
- To provide knowledge of various Navigation skills.
- To impart knowledge of various Survival at sea.
- To provide adequate knowledge of Life boats and life rafts.

COURSE OUTCOMES

	Course Outcomes	PO's	Course Level
CO 1	Students will be able to acquire the fundamentals of lifeboat and life raft launching Operations and use of various equipments present in it.	PO1	U
CO 2	Students will able to understand the general duties of seamanship	P01, PO2	U
CO3	Students will be able to interpret the basic survival methods in case of emergencies.	PO1,PO2	U
CO4	Final study provides the necessary knowledge regarding seamanship and duties related to every seaman onboard the vessel.	PO1,PO2	Ap
CO 5	Students will be able to understand the detailed information of navigation system and the purpose of various equipment present in bridge.	PO1,PO2	Ap
Total Number Lecture hours		**50**	

Module -1

Seaman & their Duties:

Ship's Department, General ship knowledge and nautical terms like Poop-Deck, Forecastle, Bridge etc. Navigational lights and Signals Port and Starboard, Forward and aft mast lights, colors and Location. Look out, precautions and bad weather, Flags used on ships, flag etiquette, Morse code and semaphore signaling, sound signals

Survival at Sea: Survival difficulties and factors, equipment available, duties of crew members, initial action on boarding, maintaining the craft. 10 Hours

Module -2

Rope Knots and Moorings:

Types of Knots, Practice of knot formation, Materials of ropes, strength care and maintenance, use of mooring line, heaving line, Rat guards, canvas and its use. Anchors: Their use, dropping and weighing anchors, cable stopper. Knots, bends and hitches, Ropes splice, Donning of Life Jackets, Life boat drills, Lowering & hoisting of Life boats. **10 Hours**

Module -3

Navigation:

General knowledge of principal stars, sextant, Navigation compasses, Echo Sounder, Log and uses, barometer and weather classification, G.M.T. and zonal time, wireless Navigational Instruments, Radar Satellite- Navigation

10 Hours

Module -4

Life Boats and Life Rafts:

Construction, Equipment carried, Carrying capacity. Davits and their operation, Launching of Life Rafts (Inflatable type). Embarkation into Lifeboat and Life Raft. Survival Pack, Stowage and securing arrangement. Rescue Boat, Immersion suit, Thermal Protective Aid.

Abandon Ship:

Manning of Lifeboat and Life raft. Muster list, Radio & Alarm signals, Distress signal (S.O.S.), Distress Calls time and Radio frequency, Pyro-techniques.

10 Hours

Module -5

Conventions and Regulations: Introduction of MARPOL convention and its annexes, Regulatory control towards environmental pollution at sea. Familiarisation with SOLAS, STOW conventions, ISPS code and other maritime codes & conventions.

10 Hours

Text Books:

1. Seamanship, J. Dinger.
2. Survival in Life Boat, Capt. Puri.
3. SOLAS, IMO

Reference Books:

1. MARPOL, IMO
2. International light, shaped & sound signals, W. Moore
3. Electronic navigation aids, G. Sonnenberg
4. Search and Rescue Manual, I.M.O. publication
5. Mariner's Hand Book, H.M.S.O.

MECHANICAL MEASUREMENTS AND METROLOGY

[AS PER CHOICE ASED CREDIT SYSTEM (CBCS) SCHEME]

SEMESTER – III

Subject Code	15 MR36	IA Marks	20
Number of Lecture Hrs / Week	04	Exam Marks	80
Total Number of Lecture Hrs	50	Exam Hours	03
CREDITS – 03			

COURSE OBJECTIVES

Students are expected to –

- Understand metrology, its advancements & measuring instruments,
- Acquire knowledge on different standards of length, calibration of End Bars, linear and angular measurements, Screw thread and gear measurement & comparators.
- Equip with knowledge of limits, fits, tolerances and gauging.
- Acquire knowledge of measurement systems and methods with emphasis on different transducers, intermediate modifying and terminating devices.
- Understand the measurement of Force, Torque, Pressure, Temperature and Strain.

COURSE OUTCOMES

At the end of the course students will be able to –

	Description	**CL**	**POs**
CO1	Understand the objectives of metrology, methods of measurement, selection of measuring instruments, standards of measurement and calibration of end bars.	U	PO1, PO6
CO2	Describe slip gauges, wringing of slip gauges and building of slip gauges, angle measurement using sine bar, sine center, angle gauges, optical instruments and straightness measurement using Autocollimator.	U	PO1, PO6
CO3	Explain tolerance, limits of size, fits, geometric and position tolerances, gauges and their design.	U	PO1, PO6
CO4	Understand the principle of Johnson Mikrokator, sigma comparator, dial indicator, LVDT, back pressure gauges, Solex comparators and Zeiss Ultra Optimeter	U	PO1, PO6
CO5	Describe measurement of major diameter, minor diameter, pitch, angle and effective diameter of screw threads by 2 – wire, 3 – wire methods, screw thread gauges and tool maker's microscope.	U	PO1, PO6
CO6	Explain measurement of tooth thickness using constant chord method, addendum comparator methods and base tangent method, composite error using gear roll tester and measurement of pitch, concentricity, run out and involute profile.	U	PO1, PO6
CO7	Understand laser interferometers and Coordinate measuring machines.	U	PO1, PO6
CO8	Explain measurement systems, transducers, intermediate modifying devices and terminating devices.	U	PO1, PO6
CO9	Describe functioning of force, torque, pressure, strain and temperature measuring devices.	U	PO1, PO6
Total Hours of Instructions		**50**	

MODULE -1

Introduction to Metrology: Definition, objectives and concept of metrology, Need of inspection, Principles, process, methods of measurement, Classification and selection of measuring instruments and systems. Accuracy, precision and errors in measurement.

System of measurement, Material Standard, Wavelength Standards, Subdivision of standards, Line and End standards, Classification of standards and Traceability, calibration of End bars(Numericals), standardization.

Linear Measurement and angular measurements:

Slip gauges- Indian standards on slip gauge, method of selection of slip gauge, stack of slip gauge, adjustable slip gauge, wringing of slip gauge, care of slip gauge, slip gauge accessories, problems on building of slip gauges (M87, M112). Measurement of angles- sine bar, sine center, angle gauges, optical instruments for angular measurements, Auto collimator-applications for measuring straightness and squareness. **10 Hours**

MODULE -2

System of Limits, Fits, Tolerance and Gauging:

Definition of tolerance, Specification in assembly, Principle of interchangeability and selective assembly, limits of size, Indian standards, concept of limits of size and tolerances, definition of fits, hole basis system, shaft basis system, types of fits and their designation (IS 919-1963), geometric tolerance, position-tolerances.

Classification of gauges, brief concept of design of gauges (Taylor's principles), Wear allowance on gauges, Types of gauges- plain plug gauge, ring gauge, snap gauge, limit gauge and gauge materials.

Comparators:

Functional requirements, classification, mechanical- Johnson Mikrokator, sigma comparators, dial indicator, electrical- principles, , LVDT, Pneumatic- back pressure gauges, solex comparators and optical comparators- Zeiss ultra-optimeter.

10 Hours

MODULE -3

Measurement of screw thread and gear:

Terminology of screw threads, measurement of major diameter, minor diameter, pitch, angle and effective diameter of screw threads by 2-wire and 3- wire methods, best size wire. Screw thread gauges,Tool maker's microscope.

Gear tooth terminology, tooth thickness measurement using constant chord method, addendum comparator method and base tangent method, measurement of pitch, concentricity, run out, and involute profile. Gear roll tester for composite error.

10 Hours

MODULE -4

Measurement systems and basic concepts of measurement methods:

Definition, significance of measurement, generalized measurement system, definitions and concept of accuracy, precision, calibration, threshold, sensitivity, hysteresis, repeatability, linearity, loading effect, system response-time delay. Errors in measurement, classification of errors.Transducers, transfer efficiency, primary and secondary transducers, electrical, mechanical, electronic transducers, advantages of each type transducers.

Intermediate modifying and terminating devices: Mechanical systems, inherent problems, electrical intermediate modifying devices, input circuitry, ballast circuit, electronic amplifiers. Terminating devices, Cathode ray oscilloscope, Oscillographs. **10 Hours**

MODULE -5

Force, Torque and Pressure Measurement:

Direct methods and indirect method, force measuring inst. Torque measuring inst., Types of dynamometers, Absorption dynamometer, Prony brake and rope brake dynamometer, and power measuring instruments.Pressure measurement, principle, use of elastic members, Bridgeman gauge, McLeod gauge, Pirani gauge.

Measurement of strain and temperature:

Theory of strain gauges, types, electrical resistance strain gauge, preparation and mounting of strain gauges, gauge factor, methods of strain measurement. Temperature Compensation, Wheatstone bridge circuit, orientation of strain gauges for force and torque, Strain gauge based load cells and torque sensors.

Resistance thermometers, thermocouple, law of thermocouple, materials used for construction, pyrometer, optical pyrometer. **10 Hours**

TEXT BOOKS:

1. **Mechanical Measurements,** Beckwith Marangoni and Lienhard, Pearson Education, 6th Ed., 2006.
2. **Engineering Metrology,** R.K. Jain, Khanna Publishers, Delhi, 2009.

REFERENCE BOOKS:

1. **Engineering Metrology and Measurements,** Bentley, Pearson Education.
2. **Theory and Design for Mechanical Measurements,III edition,** Richard S Figliola, Donald E Beasley, WILEY India Publishers.
3. **Engineering Metrology,** Gupta I.C., Dhanpat Rai Publications.
4. **Deoblin's Measurement system**, Ernest Deoblin, Dhanesh manick, McGraw –Hill.
5. **Engineering Metrology and Measurements,**N.V.Raghavendra and L.Krishnamurthy, Oxford University Press.

Scheme of Examination:

Two question to be set from each module. Students have to answer five full questions, choosing at least one full question from each module.

MATERIALS TESTING LAB

[AS PER CHOICE ASED CREDIT SYSTEM (CBCS) SCHEME]

SEMESTER – III

Subject Code	**15MRL37**	IA Marks	20
Number of Lecture Hrs / Week	01	Exam Marks	80
No of Practical Hours / Week	02	Exam Hours	03
CREDITS – 02			

COURSE OBJECTIVES

Students are expected-

1. To learn the concept of the preparation of samples to perform characterization such as microstructure, volume fraction of phases and grain size.
2. To understand mechanical behavior of various engineering materials by conducting standard tests.
3. To learn material failure modes and the different loads causing failure.
4. To learn the concepts of improving the mechanical properties of materials by different methods like heat treatment, surface treatment etc.

COURSE OUTCOMES

At the end of the course, the students will be able to:

1. Acquire experimentation skills in the field of material testing.
2. 2.Develop theoretical understanding of the mechanical properties of materials by performing experiments.
3. Apply the knowledge to analyze a material failure and determine the failure inducing agent/s.
4. Apply the knowledge of testing methods in related areas.
5. Know how to improve structure/behavior of materials for various industrial applications.

PART – A

1. Preparation of specimen for Metallographic examination of different engineering materials.
   To report microstructures of plain carbon steel, tool steel, gray C.I, SG iron, Brass, Bronze & composites.

2. Heat treatment: Annealing, normalizing, hardening and tempering of steel.
   Metallographic specimens of heat treated components to be supplied and students should report microstructures of furnace cooled,water cooled, air cooled, tempered steel.
   Students should be able to distinguish the phase changes in a heat treated specimen compared to untreated specimen.
3. Brinell, Rockwell and Vickers's Hardness tests on untreated and heat treated specimens.
4. To study the defects of Cast and Welded components using
   Non-destructive tests like:
   a) Ultrasonic flaw detection
   b) Magnetic crack detection
   c) Dye penetration testing.

PART – B

5. Tensile, shear and compression tests of steel, aluminum and cast iron specimens using Universal Testing Machine
6. Torsion Test on steel bar.
7. Bending Test on steel and wood specimens.
8. Izod and Charpy Tests on Mild steel and C.I Specimen.
9. To study the wear characteristics of ferrous and non-ferrous materials under different parameters.
10. Fatigue Test (demonstration only).

Students should make observations on nature of failure and manifestations of failure in each of the experiments apart from reporting values of mechanical properties determined after conducting the tests.

Scheme of Examination:

ONE question from part -A:	**25 Marks**
ONE question from part -B:	**40 Marks**
Viva -Voice:	**15 Marks**
Total :	**80 Marks**

MACHINE SHOP AND FOUNDRY

[AS PER CHOICE ASED CREDIT SYSTEM (CBCS) SCHEME]

SEMESTER – III

Subject Code	15MRL38	IA Marks	20
Number of Lecture Hrs / Week	01	Exam Marks	80
No of Practical Hours / Week	02	Exam Hours	03
CREDITS – 02			

COURSE OBJECTIVES:

- To provide an insight into different sand preparation and foundry equipment's.
- To provide an insight to different machine tools, accessories and attachments
- To train students into machining operations to enrich their practical skills
- To develop team qualities and ethical principles.

COURSE OUTCOMES

Students will be able to

- Demonstrate various skills of sand preparation, molding.
- Demonstrate various skills of machine operations.
- Work as a team keeping up ethical principles.

PART A

1. Machine shop

Preparation of three models on lathe involving

Plain turning, Taper turning, Step turning, Thread cutting, Facing, Knurling, Drilling, Boring, Internal Thread cutting and eccentric turning.

PART B

2. Foundry Practice

1. Use of foundry tools and other equipment's.
2. Preparation of molding sand mixture.
3. Preparation of green sand molds using two molding boxes kept ready for pouring.
   - Using patterns (Single piece pattern and Split pattern)
   - Without patterns.
   - Incorporating core in the mold. (Core boxes).
   - Preparation of one casting (Aluminum or cast iron-Demonstration only)

Question paper pattern:

One question is to be set from Part-A	40 Marks
One question is to be set from either Part-B or Part-C	20 Marks
Viva – Voce	20 Marks
Total	80 Marks