GOVERNMENT OF RAJASTHAN

BOARD OF TECHNICAL EDUCATION RAJASTHAN JODHPUR

SEMESTER SCHEME-2020-21

IV SEMESTER

(SESSION 2021-2022 & ONWARDS)

MEASUREMENTS & METROLOGY

Course Code	:	ME 4001(Same in MA 4001)
Course Title	:	MEASUREMENTS & METROLOGY
Number of Credits	:	3 (L: 2, T: 1, P: 0)
Prerequisites	:	NIL
Course Category	:	PC

COURSE OBJECTIVES:

- To study advances in technology, measurement techniques, types of instrumentation devices, innovations, refinements.
- To study the principles of instrumentation, transducers & measurement of non-electrical parameters like temperature, pressure, flow, speed, force and stress.

COURSE OUTCOMES

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

CO1	Define accuracy, precision, calibration, sensitivity, repeatability and such relevant terms in metrology.
CO2	Distinguish between various types of errors.
CO3	Understand the principle of operation of an instrument and select suitable measuring device for a particular application.
CO4	Appreciate the concept of calibration of an instrument.
CO5	Analyze and interpret the data obtained from the different measurements processes and present it in the graphical form, statistical form.

COURSE CONTENT:

1. INTRODUCTION TO MEASUREMENTS

1.1 measurement and its Significance.
1.2 Standards of measurements: Primary & Secondary.
1.6 Factors influencing selection of measuring instruments.
1.7 Terms applicable to measuring instruments: Precision and Accuracy, Sensitivity and Repeatability, Range, Threshold, Hysteresis, calibration.(Definition only)
1.8 Errors in Measurements.
1.9 Surface finish measurements

2. TRANSDUCERS AND STRAIN GAUGES

2.1 Introduction and Transducers
2.2 Strain gauge
2.3 Force measurement
2.4 Torque measurement
2.5 Pressure measurement: Mcloed gauge

3. APPLIED MECHANICAL MEASUREMENTS

3.1 Speed measurement
3.2 Displacement measurement
3.3 Flow measurement
3.4 Temperature measurement
3.5 Miscellaneous measurements
3.5.1 Humidity measurement: hair hygrometer
3.5.2 Density measurement: hydrometer
3.5.3 Liquid level measurement: sight glass, Float gauge
3.5.4 Biomedical measurement: Sphygmo monometer

4 LIMITS, FITS & TOLERANCES

4.1 Concept of Limits, Fits, and Tolerances
4.2 Selective Assembly

4.3 Interchangeability
4.4 Hole and Shaft Basis System
4.5 Taylor's Principle
4.6 Design of Plug
4.7 Ring Gauges
4.8 Concept of multi gauging and inspection
4.9 Angular Measurement
  4.9.1 Working and Use of Universal Bevel Protractor, Sine Bar, Spirit Level
  4.9.2 Principle of Working of Clinometers
  4.9.3 Angle Gauges (With Numerical on Setting of Angle Gauges)
4.10 Screw thread Measurements
  4.10.1 Two wire method
  4.10.2 Thread gauge micrometer
  4.10.3 Working principle of floating carriage dial micrometer

5. GEAR MEASUREMENTAND TESTING

5.1 Analytical and functional inspection
5.2 Rolling test
5.3 Measurement of tooth thickness (constant chord method)
5.4 Gear tooth vernier
5.5 Errors in gears such as backlash, runout, composite
5.6 Machine tool testing
  5.6.1 Parallelism
  5.6.2 Straightness
  5.6.3 Squareness
  5.6.4 Coaxiallity
  5.6.5 Roundness
  5.6.6 Run out
  5.6.7 Alignment testing of machine tools as per IS standard procedure

REFERENCE BOOKS:

1. Mechanical measurements – Beckwith Marangoni and Lienhard, Pearson Education, 6th Ed., 2006.
2. Metrology & Measurement – Anand K Bewoor,Vinay kulakarni, Tata McGraw Hill, New Delhi, 2009
3. Principles of Industrial instrumentation and control systems – Channakesava. R. Alavala, DELMAR cenage learning, 2009.
4. Principles of Engineering Metrology – Rega Rajendra, Jaico publishers, 2008
5. Dimensional Metrology – Connie Dotson, DELMAR, Cenage learning, 2007
6. Instrumentation measurement and analysis – B.C. Nakara, K.K. Chaudary, second edition, Tata Mcgraw Hill, 2005.
7. Engineering Metrology – R.K. Jain, Khanna Publishers, New Delhi, 2005.
8. A text book of Engineering Metrology – I.C. Gupta, Dhanpat Rai and Sons, New Delhi, 2005
9. Metrology for Engineers – J.F.W. Galyer and C. R. Shotbolt, ELBS
10. Engineering Metrology – K. J. Hume, Kalyani publishers

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STRENGTH OF MATERIALS

Course Code		ME 4002 (Same in MA/MP/MT 4002)
Course Title		STRENGTH OF MATERIALS
Number of Credits		3 (L: 2, T: 1, P: 0)
Prerequisites		Engineering Mechanics (2005)
Course Category		PC

COURSE OBJECTIVES:

- To understand the concept of Simple Stresses and Strains.
- To understand the concept of Strain Energy.
- To understand the concept of Shear Force and Bending Moment Diagrams.
- To understand the concept of Theory of Simple Bending and Deflection of Beams.
- To understand the concept of Torsion in Shafts and springs.
- To understand the concept of Thin Cylindrical Shells.

COURSE OUTCOMES:

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

CO1	Compute stressand strain values and find the changes in axial, lateral and volumetric dimensions of bodies of uniform section and of composite section under the influence of normal forces.
CO2	Calculate thermal stresses, in bodies of uniform section and composite sections.
CO3	Define resilience, proof – resilience and modulus of resilience and obtain expressions for instantaneous stress developed in bodies subjected to different loads.
CO4	Compute shear force and bending moment at any section of beam and draw the S.F. & B.M diagrams of for UDL and Point loads.
CO5	Calculate the safe load, safe span and dimensions of cross section.
CO6	Compare strength and weight of solid and hollow shafts of the same length and material and compute the stress and deflection of the closed coil helical spring.

COURSE CONTENT:

1 SIMPLE STRESSES AND STRAINS

1.1 Types of forces; Stress, Strain and their nature
1.2 Mechanical properties of common engineering materials
1.3 Significance of various points on stress – strain diagram for M.S. and C.I. specimens
1.4 Significance of factor of safety
1.5 Relation between elastic constants
1.6 Stress and strain values in bodies of uniform section and of composite section under the influence of normal forces
1.7 Thermal stresses in bodies of uniform section and composite sections
1.8 Related numerical problems on the above topics
1.9 Strain Energy and its significance
1.10 Derivation of strain energy for the following cases: Gradually applied load, Suddenly applied load,
Impact/shock load

2. SHEAR FORCE & BENDING MOMENT DIAGRAMS

2.1 Types of beams
2.2 Types of Loads
2.3 SFD and BM Diagram for various types of beams
2.4 Analytical method for SF and BM of Simply supported beam
2.5 Over hanging beam with point loads,
2.6 Combination of point and UDL for the above; Related numerical problems

3. THEORY OF SIMPLE BENDING AND DEFLECTION OF BEAMS

3.1 Explanation of terms: Neutral layer, Neutral Axis, Modulus of Section, Moment of

Resistance,Bending stress, Radius of curvature(Definition only)

3.3 Problems involving calculations of bending stress, modulus of section and moment of resistance
3.4 Calculation of safe loads and safe span and dimensions of cross- section
3.5 Definition and explanation of deflection as applied to beams(Standard cases only)
3.6 Related numerical problems

4. TORSION IN SHAFTS AND SPRINGS

4.1 Definition and function of shaft
4.2 Calculation of polar M.I. for solid and hollow shafts
4.3 Assumptions in simple torsion
4.4 Problems on design of shaft based on strength and rigidity
4.5 Numerical Problems related to comparison of strength and weight of solid and hollow shafts
4.6 Classification of springs
4.7 Deflection formula for closed coil helical spring (without derivation)
4.8 Stiffness of spring
4.10 Numerical problems on closed coil helical spring to find safe load, deflection, size of coil and number of coils

5. THIN CYLINDRICAL SHELLS

5.1 Explanation of longitudinal and hoop stresses in the light of circumferential and longitudinal failure of shell
5.2 Derivation of expressions for the longitudinal and hoop stress for seamless and seam shells
5.3 Related numerical Problems for safe thickness and safe working pressure

REFERENCE BOOKS:

1. Strength of Materials – D.S. Bedi, Khanna Book Publishing Co. (P) Ltd., Delhi, 2017.
2. Strength of Materials – B.C.Punmia, Ashok Kumar Jain & Arun Kumar Jain, Laxmi Publications, New Delhi, 2013.
3. Strength of Materials – S. Ramamrutham, Dhanpat Rai & Publication New Delhi.
4. Strength of Materials – R.S. Khurmi, S.Chand Company Ltd. Delhi.
5. A Text Book strength of Material– R.K. Bansal, Laxmi Publication New Delhi.

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THERMAL ENGINEERING-II

Course Code	:	ME 4003
Course Title	:	THERMAL ENGINEERING - II
Number of Credits	:	3 (L: 2, T: 1, P: 0)
Prerequisites	:	Thermal Engineering - I (ME 3005)
Course Category	:	PC

COURSE OBJECTIVES:

- To understand the working and applications of Gas turbines & Jet Propulsion.
- To understand the methods of computing various properties of steam.
- To understand the working of various Steam Boilers, functions of various accessories and mountings of boilers.
- To understand the Working of Steam Nozzles and Steam turbines.
- To understand the necessity of compounding and governing of a turbine.

COURSE OUTCOMES:

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

CO1	Explain the working cycle of gas turbines, and the working of Jet and Rocket Engines apart from identifying the fuels used for Jet and Rocket propulsion.
CO2	Compute the work done, enthalpy, internal energy and entropy of steam at given conditions using steam tables and Mollier chart.
CO3	Distinguish between water tube and fire-tube boilers and explain the function all the mountings and accessories.
CO4	Calculate Velocity of steam at the exit of nozzle in terms of heat drop analytically and by using Mollier chart.
CO5	State the necessity of governing and compounding of a turbine.
CO6	Explain the principle of working of a steam turbine and distinguish between the impulse turbines and reaction turbines.

COURSE CONTENT:

1. GAS TURBINES

1.1 Introduction and Derivation for work and efficiency ofAir-standard Brayton cycle
1.2 Gas turbines Classification
1.3 Comparison of gas turbine with reciprocating I.C. engines and steam turbines
1.4 Applications and limitations of gas turbines

2. PROPERTIES OF STEAM

2.1 Brief Descriptions of different type of steam boilers and Classification of steam boilers
2.2 Definitions of properties of steam
2.4 Determination of properties of steam using steam tables and Mollier chart applied in various applications
2.5 Simple direct problems on the above using tables and charts
2.6 Steam calorimeters

3. STEAM GENERATORS

3.1 Brief Descriptions of different type of steam boilers and Classification of steam boilers
3.2 Comparison of water tube and fire tube boilers
3.3 Description with line sketches and working of modern high pressure boilers
3.3.1 Lamont and
3.3.2 Benson boilers
3.4 Boiler mountings:
3.5 Boiler accessories:

4. STEAM NOZZLES

4.1 Flow of steam through nozzle
4.2 Velocity of steam at the exit of nozzle in terms of heat drop using analytical method and Mollier chart

4.3 Discharge of steam through nozzles
4.4 Critical pressure ratio
4.5 Methods of calculation of cross-sectional areas at throat and exit for maximum discharge
4.6 Effect of friction in nozzles
4.7 Super saturated flow in nozzles
4.8 Working steam jet injector
4.9 Simple numerical problems

5. STEAM TURBINES

5.1 Classification of steam turbines with examples
5.2 Difference between impulse & reaction turbines
5.3 Principle of working of a simple De-lavel turbine with line diagrams
5.4 Velocity diagrams
5.5 Expression for work done, axial thrust, tangential thrust, blade and diagram efficiency, stage efficiency, nozzle efficiency
5.6 Methods of reducing rotor speed
5.7 Compounding for velocity, for pressure or both pressure and velocity
5.8 Working principle with line diagram of a Parson's Reaction turbine
5.9 Velocity diagrams
5.10 Simple problems on single stage impulse turbines (without blade friction) and reaction turbine including data on blade height.
5.11 Bleeding, re-heating and re-heating factors (Problems omitted)
5.12 Governing of steam turbines:
5.12.1 Throttle
5.12.2 By-pass &
5.12.3 Nozzle control governing

REFERENCE BOOKS:

1. A Course in Thermal Engineering – S. Domkundwar & C.P. Kothandaraman, Dhanpat Rai & Publication, New Delhi.
2. Thermal Engineering – R.K. Rajput, Laxmi Publication New Delhi.
3. Thermal Engineering – P.L. Ballaney, Khanna Publishers, 2002.
4. Treatise on Heat Engineering in MKS and SI Units – V.P. Vasandani & D.S. Kumar, Metropolitan Book Co. Pvt. Ltd, New Delhi.

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AUTOMOBILE ENGINEERING

Course Code	:	ME 40041
Course Title	:	AUTOMOBILE ENGINEERING
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites	:	NIL
Course Category	:	PE

COURSE OBJECTIVES:

- To understand the basic structure and components of an automobile.
- To understand the concepts of cooling and lubricating systems.
- To understand the concepts of Ignition and transmission and steering systems.
- To understand the classification and necessity of suspension system.
- To identify different special vehicles.

COURSE OUTCOMES

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

CO1	Identify the components of an automobile with their working
CO2	Explain the concepts of cooling and lubricating systems.
CO3	Explain the concepts of Ignition and Transmission and steering systems.
CO4	Identify different suspension systems and their applications.
CO5	Differentiate the special vehicles according to the usage.

COURSE CONTENT:

UNIT-I: INTRODUCTION TO AN AUTOMOBILE

Classification of Automobiles, Chassis and body, Components of vehicle – basic structure, power unit, transmission system, accessories, superstructure. (Basic functions and arrangements) , Layout of conventional type vehicle (front engine rear wheel drive), Vehicle dimensions, minimum ground clearance, minimum turning radius.

UNIT-II: FRAME AND BODY

Chassis, Frame, Function of frame, loads or frame, Frame construction, Frame less construction), Main features – strength, stiffness, space air drag, stream lining , weight, vibration, protection against weather, corrosion, safety and economy considerations, Body alignment

UNIT-III: TRANSMISSION AND STEERING SYSTEM:

General arrangement and Principle of friction clutches; Constructional details of Single plate clutch; Constructional details of multi-plate clutch; Constructional details of centrifugal clutch; Necessity for gear ratios and type of gear box,

Working of sliding mesh gear box; Working of propeller shaft and universal joint;Types of rear axle; working and type of steering system.

UNIT-IV:SUSPENSION AND BRAKEING SYSTEM

Types and working of suspension system,Leaf spring and coil spring suspension system; Working of telescopic shock absorber; Functions of brakes and Types of brakes; Working of internal expanding brake; Working of disc brake

UNIT-V: WHEELS AND TYRES

Wheels and Tyres (Requirements of wheel, Types- pressed steel disc, wire, light alloy cast wheels, Tyres-Types (Tubed, Tubeless, Cross ply, Radial ply), Specification of tyres, Tyre maintenances, tyre trouble and repair

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REFERENCE BOOKS:

1. Automobile Engineering Vol I, II, Kirpal Singh, Standard Publishers Distributors, Delhi. 2012.
2. Automobile Mechanics, A.K. Babu, S.C. Sharma, Khanna Publications, New Delhi
3. Automotive Mechanics: Principles and Practices, Joseph Heitner, East West Press
4. Automotive Mechanics, S. Srinivasan, 2nd Edition, Tata McGraw Hill
5. Automobile Engineering Vol I and Vol II, K. M. Gupta, Umesh Publications.
6. Automotive Engineering, Jain and Asthana, Tata McGraw Hill.

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MATERIAL HANDLING SYSTEMS

Subject Code	:	ME 40042 (Sane as MA/MP 40042)
Course Title	:	MATERIAL HANDLING SYSTEMS
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites (Course code)	:	NIL
Course Category	:	PE

Course Learning Objectives:

- To know the operational features of the material handling equipment & its practical applications.
- To understand, select, operate and maintain the material handling equipments.
- To understand different material handling processes used in industries.
- To understand & appreciate safety instrumentation for equipment.

COURSE OUTCOMES:

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

CO1	Understand constructional & operational features of various materials handling systems.
CO2	Identify, compare & select proper material handling equipment for specified applications.
CO3	Know the controls & safety measures incorporated on material handling equipment.
CO4.	Appreciate the role of material handling devices in mechanization & automation of industrial process.
CO5	Understand & appreciate safety instrumentation for equipment

COURSE CONTENT:

1. **Introduction to Material Handling System**:
   - 1.1. Main types of Material handling equipments & their applications
   - 1.2. Types of load to be handled
   - 1.3. Types of Movements, Methods of stacking, loading & unloading systems
   - 1.4. Principles of Material Handling Systems; Modern trends in Materials handling.

2. **Hoisting Machinery & Equipments**:
   - 2.1. Construction and Working of different types of hoists such as Lever operated hoist, Portable hand chain hoist, Electric & Pneumatic hoists;
   - 2.2. Construction and Working of different types of cranes such as Mobile cranes, Bridge cranes, Cable cranes, & Cranes traveling on guide rails;
   - 2.3. Construction and Working of Elevating equipments such as Stackers, Industrial lifts, Freight elevators, Passenger lifts.

3. **Conveying Machinery**:
   - 3.1. Construction and Working of Traction type conveyors such as Belt conveyors, Chain conveyors, Bucket elevators, Escalators;
   - 3.2. Construction and Working of Traction less type conveyors such as Gravity type conveyors, Vibrating & Oscillating conveyors, Screw conveyors, Pneumatic & Hydraulic conveyors, Hoppers gates & Feeders.
   - 3.3. Surface Transportation Equipment: Construction, Function, Working of Trackless equipment such as Hand operated trucks, Powered trucks, Tractors, Automatic Guided vehicle

4. **Components of Material Handling Systems:**
   - 4.1. Flexible hoisting appliances such as Welded load chains, Roller chains, Hemp ropes, Steel wire ropes, Fastening methods of wire & chains, Eye bolts, Lifting tackles, Lifting & Rigging practices;
   - 4.2. Load handling attachments: a) Various types of hooks-Forged, Triangular eye hooks, Appliances for suspending hooks b) Crane grab for unit & piece loads c) Electric lifting magnet, vacuum lifter. d) Grabbing attachment for loose materials e) Crane attachment for handling liquids/molten metals;

5. **Mechanism used in Material Handling Equipment**:
   - 5.1. Steady state motion; Starting & stopping of motion in following mechanisms: Hoisting mechanism, Lifting Mechanism, Traveling Mechanism.

5.2. Selection of Material Handling Equipment: Factors affecting choice of material handling equipment such as Type of loads, Hourly capacity of the unit, Direction & length of travel,

Reference Books:

1. Material Handling (Principles & Practice) – Allegri T. H., CBS Publisher, New Delhi.
2. Plant Layout & Materials Handling – Apple J. M., John Wiley Publishers.
3. Material Handling Equipment – N. Rundenko, Peace Publisher, Moscow.
4. Material Handling Equipment – M. P. Alexandrov, MIR Publisher, Moscow.
5. Material Handling Equipment – Y. I. Oberman, MIR Publisher, Moscow.

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REFRIGERATION AND AIR-CONDITIONING

Course Code	:	ME 40051(Same in MA 40051)
Course Title	:	REFRIGERATION AND AIR-CONDITIONING
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites	:	Thermal Engineering - I (ME 3005)
Course Category	:	PE

COURSE OBJECTIVES:

- To understand the basics of Refrigeration cycles.
- To understand basics of vapour compression and vapour absorbtion systems.
- To identify components and refrigerants and lubricants of a refrigeration system.
- To understand control strategies for refrigeration system.
- To understand the basics about air conditioning systems.

COURSE OUTCOMES

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

CO1	Define refrigeration and types of Refrigeration cycles
CO2	Explain Vapour Compression and Vapour Absorbtion System working principles
CO3	Identify the components required for refrigeration system.
CO4	Identify the controlling components for a refrigeration system.
CO5	Explain the working principles of Air-conditioning.

COURSE CONTENT:

UNIT-I: INTRODUCTION TO REFRIGERATION

Definition of Refrigeration; Refrigerating effect-unit of refrigeration- Coefficient of performance; Types of Refrigeration-Ice, dry ice, Steam jet, Throttling, Liquid nitrogen refrigeration; Carnot refrigeration Cycle(Introduction only); Air refrigeration- Bell - Coleman cycle, Advantage and disadvantages in air refrigeration; Simple problems

UNIT-II: REFRIGERATION SYSTEMS

Working of Vapour compression refrigeration cycle with expression; Representation of the vapour compression cycle on P-H, T-S & P-V Diagram; Types of Vapour Compression cycle and its advantages and disadvantages; Simple Vapour absorptions cycle(Basic Introduction only); Simple Electrolux system for domestic units; Comparison of Vapour absorption and vapour compression system; Simple problems on vapour compression cycle.

UNIT-III: REFRIGERATION EQUIPMENTS

Types of compressors used in refrigeration

Types of Condensers used in refrigeration

natural and forced draught cooling system(Only Basic Introduction); Advantages and disadvantages of air cooled and water-cooled condensers;Types of Evaporators.

Refrigerants and lubricants: Introduction and Properties of good refrigerants; Classification of refrigerants Detection of refrigerants leakage; Charging the system with refrigerant; Lubricants used in refrigeration

UNIT-IV: REFRIGERANT FLOW CONTROLS

Types of Expansion devices used in refrigeration; High side and low side float valve; Solenoid valve; Evaporator pressure regulator.

Application of refrigeration: Slow and quick freezing; Cold storage and Frozen storage; Dairy refrigeration; Ice making industry; Water coolers.

UNIT-V: AIR CONDITIONING

Introduction to Air conditioning; Psychometric chart and its usefor various processes; Equipments used in air conditioning units and plants.

Refrigeration and Air-conditioning tools: Tools used in refrigeration and Air conditioner installation; Installation procedure; Faults in refrigeration and air conditioning system; Servicing procedure.

REFERENCE BOOKS:

1. Refrigeration and Air Conditioning – Sadhu Singh, Khanna Book Publishing Co., New Delhi
2. Refrigeration and Air Conditioning – S. Domakundawar, Dhanpat Rai publications.
3. Refrigeration and Air Conditioning – A.S.Sarao& G.S. Gabi, 6th edition, Satya Prakashan publications, New Delhi, 2004.
4. Principles of Refrigeration – Roy J.Dossat, 5th edition, Pearson Publications, 2001.
5. Refrigeration and Air Conditioning – M.Zakria Baig, Premier/ Radiant Publishing House.
6. Refrigeration and Air Conditioning – C.P Arora, Tata McGraw Hill Education, 2000.

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COMPUTER INTEGRATED MANUFACTURING

Course Code	:	ME 40052
Course Title	:	COMPUTER INTEGRATED MANUFACTURING
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites	:	NIL
Course Category	:	PE

COURSE OBJECTIVES:

- To understand General Principles of Mechanical Engineering.
- To understand laws of thermodynamics, thermal and thermodynamic Processes
- To understand working principles of power developing and power absorbing devices
- To understand basic materials and manufacturing processes

COURSE OUTCOMES:

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

CO1	Understand the formulation of Liner Programming
CO2	Analyze and Convert the problem into a mathematical model.
CO3	Understand the dual LP and Primal Dual relation problems
CO4	Understand and implement the transportation problems at workplace
CO5	Solve the assignment problems, solving linear programming approach using software

COURSE CONTENT:

UNIT-I

Concept of Computer Integrated Manufacturing (CIM); Basic components of CIM; Distributed database system; distributed communication system, computer networks for manufacturing; future automated factory; social and economic factors

UNIT-II

Computer Aided Design (CAD): CAD hardware and software; product modelling, automatic drafting; engineering analysis; FEM design review and evaluation; Group Technology Centre.

UNIT-III

Computer Aided Manufacturing (CAM), Computer assisted NC part programming; Computer assisted robot programming; computer aided process planning (CAPP); computer aided material requirements planning (MRP)

UNIT-IV

Computer aided production scheduling; computer aided inspection planning; computer aided inventory planning, Flexible manufacturing system (FMS); concept of flexible manufacturing.

UNIT-V

Integrating NC machines, robots, AGVs, and other NC equipment; Computer aided quality control; business functions, computer aided forecasting; office automation

REFERENCE BOOKS:

1. CAD, CAM, CIM - P.Radhakrishnan and S.Subramanyan, New Age International Publishers.
2. Computer Integrated Manufacturing - Paul G. Rankey, Prentice Hall.
3. Robotics Technology and Flexible Automation – S.R. Deb, Tata McGraw Hill.

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MATERIAL TESTING LAB

Course Code	ME 4006 (Same in MA/MT 4006)
Course Title	MATERIAL TESTING LAB
Number of Credits	1 (L: 0, T: 0, P: 2)
Prerequisites	Material Science & Engineering (ME 3002) Strength of Materials (ME 4002)
Course Category	PC

COURSE OBJECTIVES:

- To identify the type of material based on its grain structure
- To learn the procedure for identifying the cracks in the material
- To understand various material testing methods to determine mechanical properties such as yield stress, Ultimate stress, percentage elongation, Young's Modulus etc.

COURSE OUTCOMES

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

CO1	Identify the given specimen by viewing the micro structure using metallurgical microscope
CO2	Identify the cracks in the specimen using different techniques
CO3	Determine the various types of stress and plot the stress strain diagram for mild steel.
CO4	Determine the torsion, bending, impact and shear values of given materials
CO5	Determine the modulus of rigidity, strain energy, shear stress and stiffness of coil spring

PRACTICALS:

1. Prepare a specimen and examine the microstructure of the Ferrous and Non- ferrous metals using the Metallurgical Microscope.
2. Detect the cracks in the specimen using
   (i) Visual inspection and ring test (ii) Die penetration test (iii) Magnetic particle test.
3. Determination of Rockwell's Hardness Number for various materials like mild steel, high carbon steel, brass, copper and aluminium.
4. Finding the resistance of materials to impact loads by Izod test and Charpy test.
5. Torsion test on mild steel – relation between torque and angle of twist determination of shear modulus and shear stress.
6. Finding Young's Modulus of Elasticity, yield points, percentage elongation and percentage reduction in area, stress strain diagram plotting, tests on mild steel.
7. Determination of modulus of rigidity, strain energy, shear stress and stiffness by load deflection method (Open & Closed coil spring)
8. Single or double Shear test on M.S. bar to finding the resistance of material to shear load.

REFERENCE BOOKS:

1. Measurement system (Application and Design) – Ernest O Doebelin.
2. Strength of Materials – R.S. Khurmi, S.Chand Company Ltd. Delhi
3. A Text Book strength of Material– R.K. Bansal, Laxmi Publication New Delhi

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MEASUREMENTS & METEOROLOGY LAB

Course Code	:	ME 4007 (Same in MA 4007)
Course Title	:	MEASUREMENTS & METEOROLOGY LAB
Number of Credits	:	1 (L:0, T:0 , P:2)
Prerequisites	:	Measurements & Meteorology (ME 4001)
Course Catergory	:	PC

COURSE OBJECTIVES:

- To understand techniques for precise measurement of the dimensions of various objects and shapes.

COURSE OUTCOMES:

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

CO1	Measure various component of linear measurement using Vernier calipers and Micrometre.
CO2	Measure various component of angle measurement using sine bar and bevel Protractor
CO3	Measure the geometrical dimensions of V-thread and spur gear

PRACTICALS:

1. Measure the diameter of a wire using micrometre and compare the result with digital Micrometer.
2. Measure the angle of the machined surface using sine bar with slip gauges.
3. Measure the angle of a V-block / Taper Shank of Drill / Dovetail using universal bevel protractor.
4. Measure the dimensions of ground MS flat/cylindrical bush using Vernier Calliper compare with Digital/Dial Vernier Calliper.
5. Measure the geometrical dimensions of V-Thread using thread Vernier gauge.
6. Measure the thickness of ground MS plates using slip gauges.

REFERENCE BOOKS:

1. Engineering Metrology – R. K. Jain
2. Engineering precision metrology – R. C. Gupta
3. A Hand book of Industrial Metrology – ASME

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THERMAL ENGINEERING LAB-II

Course Code	:	ME 4008
Course Title	:	THERMAL ENGINEERING LAB-II
Number of Credits	:	1 (L: 0, T: 0, P: 2)
Prerequisites	:	Thermal Engineering - I (ME 3005) Thermal Engineering - II (ME 4003)
Course Category	:	PC

COURSE OBJECTIVES:

- To understand the working of boilers, compressors and IC engines.
- To observe various parts of engines and understand their functions.
- To perform various tests on IC engines and calculate performance parameters.
- To understand economical and optimum running conditions of the engines.

COURSE OUTCOMES

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

CO1	Evaluate the performance characteristics of single cylinder diesel/petrol engine at different loads and draw the heat balance sheet.
CO2	Find the indicated power of individual cylinders of an engine by using morse test.
CO3	Evaluate the performance characteristics Multi stage air compressor
CO4	Evaluate the co efficient of performance of refrigerator
CO5	Find the thermal conductivity of material

PRACTICALS:

1. Study of high pressure boiler with model.
2. Study of boiler mountings and accessories.
3. Conduct performance test on VCR test rig to determine COP of the refrigerator.
4. Conduct performance test on multi stage reciprocating compressor.
5. Conduct Morse test to determine the indicated power of individual cylinders.
6. Conduct Performance test on 2-S CI/SI engine.
7. Conduct Performance test on 4-S CI/SI engine.
8. Conduct Heat balance test on CI/SI engine.
9. Conduct Economical speed test on 4-S CI/SI engine.
10. Thermal conductivity test on
    1) Thick slab 2) Composite wall 3) Thick cylinder
11. Leak detection of refrigeration equipment.
12. Conduct performance test on A/C test rig to determine COP of the refrigerator.

REFERENCE BOOKS:

1. Thermal Engineering – P.L. Ballaney, Khanna Publishers, 2002
2. A Course in Thermal Engineering – S. Domkundwar & C.P. Kothandaraman, Dhanpat Rai & Publication New Delhi
3. Thermal Engineering – R.S. Khurmi and J.K. Gupta, 18th Edition, S. Chand & Co, NewDelhi

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ESSENCE OF INDIAN KNOWLEDGE AND TRADITION

Course Code	ME 4222 (Same in All Branches of Engg.)
Course Title	Essence of Indian Knowledge and Tradition
Number of Credits	0(L-2,T-0, P-0)
Prerequisites	None
Course Category	AU

COURSE CONTENTS:

Basic Structure of Indian Knowledge System:

(i)वेद,

(ii)उन्नवेद (आयुवेद,धनुवेद,गन्धवेद,स्थान्नत्यआदद)

(iii)वेदथाथांग (शिक्था, कलन्न, ननरुत, व्थाकरण, ज्योनतषछथांद),

(iv)उन्नथाङ्ग (धर्मशथास्न, र्ीर्थाथांसथा, नुरथाण, तकशरथास्न)

- •Modern Science and Indian Knowledge System
- •Yoga and Holistic Health care
- •Case Studies.

REFERENCES /SUGGESTED LEARNING RESOURCES:

1. V. Sivarama Krishna, " Cultural Heritage of India- Course Material", Bhartiya Vidya Bhavan, Mumbai, fifth Edition, 2014.
2. Swami Jitatmanand, " Modern Physics and Vedant", Bhartiya Vidya Bhavan.
3. Fritz of Capra, " The wave of Life".
4. Fritz of Capra, " Tao of Physics".
5. V N Jha, " Tarka sangraha of Annam Bhatta, International" Cinmay Foundation, Velliarnad, Amakuam.
6. R N Jha, " Science of Consciousness Psychotheraphy and Yoga Practices" Vidya nidhi Prakasham, Delhi, 2016.

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