

## DE ME SEM-5 Detail Syllabus of Thermal engg-2(3351901)

Teaching Scheme (In Hours)			Total Credits (L+T+P)			Examination Scheme		
Theory Marks			Practical Marks			Total Marks		
L	T	P	C	ESE	PA	ESE	PA	150
2	0	2	4	70	30	20	30	

### 1. Internal combustion engines :

IC Engine-concept (comparison with External Combustion engine- EC), classification, working principle and terminology used. Main components of IC engine and their functions. 1 Petrol engines (Spark Ignition-SI) & diesel engines (Compression Ignition-CI)-two strokes and four strokes both: i) Working principles. ii) Cycles on P-V and T-s diagram. iii) Elements-sketch, working and functions. iv) Various systems- cooling, fuel injection (includes carburetion, fuel pump, fuel injectors, Multi Point Fuel Injection (MPFI), etc.), ignition, governing (quality, quantity and hit and miss governing), exhaust, etc. v) Comparison between SI & CI Engines. vi) Theoretical and actual valve timing diagrams. MPFI- need and working. Concept of scavenging and turbocharger. Concept of Common Rail Direct Injection System-(CRDI) for diesel engine. Performance testing of IC engines and its heat balance sheet (Simple numerical examples) with familiarization with testing as per BIS

**2. Alternate fuels:** Alternatives fuels: Types, properties, compositions, advantages, disadvantages and implementation issues- includes mainly Compressed Natural Gas (CNG), Liquefied Petroleum Gas (LPG) and Biodiesel. Effect of these fuels from pollution point of view. Supply system requirement for CNG and LPG as alternate fuel in vehicle. Conversion devices/ kits for SI Engines- vaporizer/ PRV for fuel compatibility, piping and allied needs.

**3. Refrigeration:** Introduction to refrigeration. Reversed Carnot cycle & Bell column cycle. (No numerical) Unit of refrigeration & basic terminology. Vapor compression refrigeration cycle (VCRS), working with the help of P-V, T-s & P-h diagrams. VCRS components, types, their construction, working, applications, (components include compressor- Reciprocating, Rotary, Screw and scroll; condensers- Air cooled and water cooled; evaporators- Dx type, flooded, shell and tube type; expansion devices -Automatic, thermostatic expansion valve and capillary tube, High side float valve). Performance of VCRS based on coefficient of performance (COP), simple numerical. Effect of change in operating conditions (condenser pressure, evaporator pressure, sub cooling, superheating) on performance of VCRS & its representation on P-h diagram (with suitable numerical examples). Application of VCRS: Ice Plant, cold storage, water cooler, domestic refrigerator, deep freeze- block diagram, components, working. Basic concept of Vapor absorption refrigeration system. Refrigerant classification, Desirable properties of refrigerants, and properties & applications of commonly used refrigerants including R22, R134a, Hydro Carbon-HC and R717 (Ammonia), need of new refrigerants.

**4. Air-Conditioning:** Introduction to air conditioning. Air conditioning- types and its applications. Psychometric- properties of air. Representation of psychometric properties on chart (simple numerical using chart). Various air conditioning processes on psychometric charts. Desert cooler, window and split air conditioners- components and working. Air conditioning fans- types, constructional features and applications.

**SYLLABUS OF DESIGN OF MACHINE ELEMENT(3551902)**

Teaching Scheme (In Hours)			Total Credits (L+T+P)			Examination Scheme		
Theory Marks			Practical Marks			Total Marks		
L	T	P	C	ESE	PA	ESE	PA	200
3	0	2	5	70	30	20	30	

**1. Introduction:** General consideration and factors influencing the design of machine elements and design process. Various materials used in manufacturing of machine elements and their properties. Types of loads, types of stresses, concept of stress concentration and factor of safety. Standardization and preferred numbers, numeric examples on preferred numbers.

**2. Design of machine elements subjected to direct stresses:** Illustration of simple machine elements subjected to direct stresses-independently and identification of resisting areas (simple numeric examples). Design of simple machine elements subjected to uni-axial direct stresses-independently. Design procedure (with numeric examples), steps, identification of resisting areas and design of: i. Knuckle joint. ii. Cotter joint. iii. Riveted joints.

**3. Design of machine elements subjected to bending stresses:** Principle of bending and its fundamental equation. Modulus of various sections, example of pure bending like levers, beams, axle, etc. Types of levers. Design procedure (with numeric example) of levers including cross section of arms, bosses and pins. Design procedure (with numeric example) of leaf spring.

**4. Design of machine elements subjected to direct and twisting moments:** Fundamental equation of twisting moment with design procedure. Types of shafts with important features of each. Design of shafts (with numeric examples). Types of keys, applications of each and design procedure (with numeric examples). Types of couplings and applications. Design of muff and flange couplings (with numeric examples). Types of spring, terminology related to helical spring and applications of helical spring.

**5. Design of machine elements subjected to direct and bending stresses:** Eccentric loading- i. Concept. ii. Illustrations like frame, C-clamp, Bracket, Foundation bolt, Bolts in flange, etc. iii. Design of machine element like C-Clamp, bracket, foundation bolt and bolts in flange.(with numeric examples).

**6. Design of pressure vessels:** Types and applications of pressure vessels used in industries. State Range of pressure also. Design of thick and thin cylinders (with numeric examples). Design of thin spherical shell (with numeric examples).

**7. Selection procedure for bearings:** Classification of bearings. Bearing designation as per IS. Antifriction bearings: types, advantages, applications. Selection procedure of anti-friction bearings. Calculation for anti-friction bearings: basic dynamic load, load rating, equivalent load, life.

**SYLLABUS OF MANUFACTURING ENGINEERING-3(3351903)**

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PA	ESE	PA	200
3	0	4	7	70	30	40	60	

## 1. Introduction to Manufacturing Engineering-III:

Need, Scope & importance of Manufacturing Engineering-III in the industries.

**2. Grinding and super finishing processes:** Classification, Constructional features including coolant and lubrication systems, motion and power transmission path, working, application and cutting parameters of following grinding machines with "commonly used grinding wheels and work piece materials" :i. Cylindrical (centre less, internal and external) grinding machines.ii. Bench and portable grinder.iii. Tool and cutter grinding machine.iv. Profile grinding machine. Methods of mounting work piece on cylindrical grinding machines (Including chuck and mandrel).Honing, lapping, buffing and other super finishing processes and their applications.

**3. Gear manufacturing and finishing processes:** Types of gears, nomenclature of spur and helical gears.Gear generating and forming processes-concept, differences and applications. Classification, constructional features including coolant and lubrication systems, motion and power transmission path, working and application of gear milling, gear hobbing and gear shaping machines.Nomenclature and sketch of gear hob and gear shaping cutter.Gear Cutting parameters for commonly used materials and work-piece Tool mounting methods on gear milling, gear shaping and gear hobbing machines. Gear finishing processes- shaving & grinding.

**4. Thread production methods:** Thread nomenclature and important terminologies used in thread production.Various methods of thread productions, its applications, advantages and limitations. Constructional features including coolant and lubrication systems, motion and power transmission path, working and application of various threads production machines/ processes like lathe, rolling, grinding, tapping, etc.Thread Cutting parameters for commonly used materials and work-piece. Tool mounting methods on thread production processes.

**5. Broaching, jig boring and special purpose machine tools:** Types, constructional features including coolant and lubrication systems, motion and power transmission path, working and applications of broaching machines.Different Shapes that can be produced by broaching process.Nomenclature and sketch of a simple broach.Types, constructional features including coolant and lubrication systems, motion and power transmission path,, working and application of jig boring machines. Various SPM (Only names) and their areas of application.Parts fit for SPM.Comparison of SPM with other automates.

**6. Non-conventional and advance methods of machining:** Need of nonconventional machining and Comparison between conventional & non-conventional machining methods. Classification, working principles, application and working parameters of following non- conventional machining methods:i. Electro chemical machining (ECM).ii. Electro discharge machining (EDM)including wire cut and die sinking.iii. Ultrasonic machining (USM).iv. Laser beam machining (LBM).v. Abrasive jet machining (AJM).Criterion for selection of non- conventional machining methods.6.4 Need of micro electro-mechanical systems (MEMS).Materials and their properties used for MEMS manufacturing.6.6 Working principle and applications of MEMS fabrication techniques:i. Chemical vapour deposition.

Need of nonconventional machining and Comparison between conventional & non- conventional machining methods.Classification, working principles, application and working parameters of

following non-conventional machining methods:i. Electro chemical machining (ECM).ii. Electrodischarge machining (EDM)including wire cut and die sinking.iii. Ultrasonic machining (USM).iv. Laser beam machining (LBM).v. Abrasive jet machining (AJM).6.3 Criterion for of non-conventional machining methods. Need of micro electro-mechanical systems (MEMS). Materials and their properties used for MEMS manufacturing.6.6 Working principle and applications of MEMS fabrication techniques:i. Chemical vapour deposition.ii. Lithography.iii. Photolithography.iv. Dry & wet etching.

**SYLLABUS OF INDUSTRIAL ENGINEERING(3351904)**

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	PA	ESE	PA	150
3	0	2	5	70	30	20	30	

- 1. Introduction to Industrial Engineering:** Industrial engineering-definition, objectives and techniques.Scope, importance and applications of industrial engineering.Methodology and approach of Industrial engineering.Productivity – concept, definition, importance and ways to enhance it, numeric examples. Introduction to work study.1.6 Introduction to statistical quality control (SQC).
- 2. Work Study:** Work study-Definition, techniques and role to enhance productivity. Importance of human factors in application of work study techniques.Basic procedure of method study.Methods of recording data for method study using standard symbols, process charts and diagrams.Preparation of operation (outline) process chart for given mechanical assembly having6-8 components.Process planning-concept, meaning, importance, functions, procedure and forms used.Information required for process planning and information available from process planning.Prepare process plan for given mechanical components, take 2-3 components. Preparation of flow process chart and flow diagram for given mechanical components having at least 6-8 major operations. Given the process plan, operation process chart and flow diagram, develop questioning techniques in analyzing data for method study. Also develop and improve the method, based on analysis of given data.Principles of motion economyapplied in (a) use of human body, (b) design of work place layout (c) design of tools and equipment.Principles of micro motion study, Therbligs and SIMO chart. Man and machine chart. Basic procedure of work measurement.Equipment used in time study.Job elements and their types. Methods of measuring time-cumulative and fly back timing.Concept of rating and rating scale.Allowances-types, normal values and applications.Calculation of basic time, standard time and work content.Concept of work sampling/ activity sampling.
- 3. Quality Assurance:** Definition of quality, quality control (QC), quality assurance (QA), statistical quality control (SQC) and reliability.Importance of quality. Difference between reliability and quality control.Factors affecting and improving reliability. QA tools.Concept of

total quality cycle, quality of design, quality of performance, quality of conformity and total quality. Difference between inspection and quality control. Fundamentals of statistics-types of variations, frequency, class boundary and midpoint, frequency distribution, frequency histogram, frequency bar chart and polygon chart. Frequency distribution curve, central tendency, spread or dispersion and range, mode, median and mean, standard deviation and variance with numeric examples. Concept of probability and normal distribution. Area under normal distribution and examples on normal distribution. Introduction to binomial

4. **Statistical Quality Control (SQC):** Concept of variability. SQC tools and statistical fundamentals. Concept and differences between variables and attributes. Control charts for variable quality-types, objectives, applications, calculations of control limits and range/mean, methods to plot and interpretations (X bar-R chart) and examples. Control charts for attribute quality-types, objectives, applications, calculations of control limits and range/mean, methods to plot and interpretations (p, np, 100p and c chart) and examples. Process capability – meaning, definition and method to calculate, numeric examples. Acceptance sampling: i. Quality control of incoming raw material and components. ii. Concepts of random sampling. iii. Sampling plans: definition, terminology, types (Single, double and multiple), implementing plans based on given input. iv. OC curve-concept, need, types and importance, interpretation of given OC curve.
5. **Recent trends in industrial:** International Organization for standardization and its role, ISO standard series and quality managements system. Total Quality Control (TQC) and Total Quality Management (TQM)- philosophical concepts. Concept of six sigma and its applications. Concept and applications of Kaizen. Definition, objectives and applications of ergonomics. Normal and maximum work area. Environmental requirements of work place. engineering.

**SYLLABUS OF ESTIMATION, COASTING AND CONTRACTING(3351905)**

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	PA	ESE	PA	150
2	0	2	4	70	30	20	30	

1. **Introduction:** Need, Scope & importance of ECC in industries. Difference between costing and estimating. Terminology associated with various cost elements and their classification. Terminology associated with overheads, their classification and allocation. Determination of selling price and catalogue price. Depreciation and obsolescence: of Machine Hour Rate (MHR) and process hour rate (PHR). Method to calculate MHR for any machine/machine tool. Method and example to calculate MHR of Lathe, Milling, Drilling, Grinding and Press tool. Method to calculate PHR for any process.
2. **Break even analysis:** Classification of costs as fixed and variable costs. Relationship between the costs and quantity of production. Break Even Chart : i. Definition of Break Even Point (BEP) and its needs in industry. ii. Procedure of construction of Break Even Chart. iii. Assumptions made in constructing Break even chart. iv. Calculation of BEP analytically and graphically. v.

- Margin of safety, its importance and its derivation.vi. Effect of changing various parameters on BEP.vii. Numeric examples.Method and example to calculate PHR of running diesel generating set, running air conditioner, running refrigerator, welding and gas cutting.
3. **Cost estimation of welding:** Elements of cost in arc welding. Factors effecting arc welding cost.Estimating cost elements for:i. Consumables in arc welding and gas cutting.ii. Gas cutting.iii. Arc welding.Estimation of production cost of given welding job for above methods.
  4. **Cost estimation of forging and casting:** Cost terminology associated with forging shop. The procedure of calculating material cost of a product for forging shop (including inputweight, cut weight, forged weight etc.).Procedure of estimating cost offorgingdies.Procedureof estimating forging cost.Given the forged component, estimate forging cost.Cost terminology associated with foundry shop.The procedure of calculating material cost of a product for foundry shop.Procedure of estimating cost of pattern making. Procedure of estimating foundry cost.Given the casting component, estimate foundry cost.
  5. **Cost estimation of machined part:** The terminology associated with machine shop estimation.Procedure to estimate material cost.Procedure of estimating cost of machined part for following operations:i. Lathe operations (Facing, outside/inside turning, boring, drilling on lathe, grooving and out side threading).ii. Drilling operations (Drilling, reaming, tapping).iii. Shaping operations.iv. Milling operations (Face milling, side and face cutting, end milling, key way milling and gear forming).v. Cylindrical grinding operations (Plain cylindrical grinding).For given machined part, estimate material cost andmachining cost.
  6. **Estimation of process cost:** Understand importance of estimating various process costs. Procedure and steps to estimate cost for following processes:i. Producing power using diese generating set (cost per hour and cost per unit).ii. Power produced at thermal power plants. (Cost per unit).iii. Pouch packaging.(Cost per pouch).iv. Heat exchanger, cooling or heating.(Cost per hour).v. Ice plant.(Cost per unit weight).Given the required set of input, estimate the cost of processes specified above.
  7. **Budgeting and contracting:** 7.1. Define budget and budgetary control.7.2. Purpose of budget.7.3. Various types of budgets.7.4. Benefits of budget.7.5. With given example, interpret industrial budget.7.6. Prepare simple budget given required input data.7.7. Explain various accounting terminology like book value, Net Present Value, Work in progress, Gross Domestic Product (GDP),balance sheet terminology,etc.7.8. Define contracts, its characteristics and advantages.7.9. Types of contract.7.10. Tendering, manual tendering and E-tendering. 7.11. Provision of different conditions in a contract.7.12. Documents required in an engineering contract (explain).7.13. Prepare a contract for a given input situation.

**SYLLABUS OF SELF EMPLOYEMENT AND ENTREPRENEURSHIP(3351906)**

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	PA	ESE	PA	150
3	0	2	5	70	30	20	30	

1. **Introduction to self-employment and entrepreneurship development:** Introduction of self-employment i. Concept and need in present Indian job market context. ii. Characteristics of self-employment areas for mechanical engineering field. iii. Broader ways to identify self-employment areas in mechanical engineering. Creativity- concept, examples related to applications in mechanical engineering, ways to develop. Innovativeness- concept, examples related to applications in mechanical engineering, ways to develop. Entrepreneurship development: i. Concept and need. ii. Scope in local and global market. iii. Qualities of entrepreneur and Characteristics of Diploma holder as a self-employer like developing networking and personal contacts, communication skills, transferable work skills, positive work skills, conflict resolution, professional dress, workplace legal issues, work ethic, etc. Concept and importance of productivity, quality, cost consciousness and customers' satisfaction. Types of enterprise- i. Sole partnership. ii. Partnership firm. iii. Joint stock company. iv. Co-operative society.
2. **Entrepreneurial support agencies:** Definition – Micro, small and medium industries. Registration process of an enterprise with Government agencies. Name, type and role of state and national level support agencies for: i. Sources of information. ii. Financial assistance. iii. Technical assistance.
3. **Project set up planning:** Product (Physical and service both-having mechanical features) selection: i. Concept and importance ii. Product selection iii. Effect of competitive or similar types of products on product selection iv. Product development stages. Process Selection: i. Concept and importance. ii. Factors affecting process selection. iii. Technology life cycle. iv. Productivity-concept & importance. v. Flexibility. Process Conversion- Capacity Planning : i. Concept. ii. Importance. iii. Basic method to assess / estimate capacity. Selection of location and layouts i. Concept. ii. Factors affecting selection of location. iii. Objectives and types of plant layout. iv. Factors affecting plant layout.
4. **Project proposal planning:** 7-M resources. Marketing- definition, need for enterprise, 4Ps channels (product, price, place and promotion). Market survey-concept, need and methods. Managing finance : i. Terminology used in financial management. ii. Concept of financial statement and types (balance sheet, profit & loss statement and funds flow statement). Project report preparation for mechanical feature based product: i. Meaning of project planning and report. ii. Feasibility study. iii. Details required for preparing project plan. iv. Project cost estimation. v. Cost, Volume and Profit (CVP) analysis.
5. **Enterprise and risk management:** Concept of risk in the context of enterprise / project. Uncertainty and certainty of project elements. Decision making under risk. Methods of risk management. Strength, Weakness, Opportunity and Threat (SWOT) analysis.
6. **Case studies:** Case studies of entrepreneur and self employer. : (at least two for success and two for failure.) i. Important features. ii. Reasons for success and failures. iii. Analyzing success and failure criteria. iv. Integration of case analysis conclusions in enterprise management for improvement.

**SYLLABUS OF PROJECT-1(3351908)**

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PA	ESE	PA	100
0	1	3	4	0	0	40	60	

1. **Introduction:** Introduction. Need, importance and objectives.Examples of projects. Expected benefits.
2. **Basic techniques and project problem identification:** Attitude-Dos and Don'ts in context of industrial environment.Need-the mother of invention.Basic techniques. (It is expected that student also uses these basic techniques to develop their engineering and innovative thinking pattern, i.e. student uses these techniques as their thought drivers/techniques to identify/define problems/projects.)i. Productivity.ii. Quality.iii. Creativity and innovativeness.iv. Cost/waste reduction.v. Safety/security.vi. Pollution reduction/removal.vii. Humanity.viii. Cause and effect diagram (Fish bone diagram).ix. 5-S Strategies.x. 7-S Framework.xi. SWOT analysis.xii. Value Analysis.xiii. Market survey. xiv. Other/s included by concerned teacher.Identification of problem/ project.(Each student will suggest one problems/ projects. Emphasis for project selection should be given to the area of elective group selected.).The project can be of:i. Manufacturing type at institut place. For critical processes/ operations, help of industries can be taken.ii. Live prople solution at industry place.iii. Combination of above two.The project should also be: Preferably innovative in nature.ii. Feasible using the infrastructure of the institute.iii. To give practice for drawing/drafting using software.iv. Incorporating major manufacturing processes if possible.v. Non repetitive in nature.vi. To develop the generic as well as technology related skills.vii. Having measurable and analytical end results.Prepare details and assembly production drawings for manufacturing type projects.Define live problems at industry place. Also prepare necessary drawings for live problem solution at industry place.Prepare bill of material.