GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT Course Curriculum

DE ME SEM-4 Detail Syllabus of Manufacturing Engineering -2 (3341901)

TEACHING AND EXAMINATION SCHEME:

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	

Unit – I Introduction and mechanics of cutting

1.1 Need, scope & importance of manufacturing processes in industries. 1.2 Need of attitude, knowledge & skill required for shop floor supervisor in machine tools based industries. 1.3 Differentiate between forming and generating processes. 1.4 Mechanics of cutting action, orthogonal and oblique cutting. (Without derivation). 1.5 Chip formation, types of chips. 1.6 Forces acting on tool and chip, methods to compute cutting force using dynamometer. 1.7 Concept and definition of cutting speed, feed and depth of cut. 1.8 Cutting fluid- basic need, types, properties and its applications. 1.9 Influence of cutting variables on surface finish, tool life, economy, and mass production. 1.10 Safety precautions in machine tools.

Unit- II Basic machine tools-I

2.1 Define and classify basic machine tools. 2.2 Movements of tool, job, slides and work holding devices during cutting operation on various machine tools. 2.3 Lathe machine. i. Types. ii.Working principle (using block diagram). 2.4 All geared head stock centre lathe. i.Constructional features. ii. Kinematics-(drive, head stock, feedbox, carriage, cross slide, top slide, swivel, apron, tailstock,) constructional sketch, working, and use. iii. Detailed specifications. iv. Operations performed. v. Work holding devices-constructional sketch, working and applications. (3 jaw chuck, 4 jaw chuck, face plate, centers). vi. Lead screw and feed rod mechanisms. vii. Thread cutting setting-concept methods and simple numerical. viii. Accessories- types, constructional sketch, working and applications. 2.5 Metal removal rate (MRR) – concept and method to calculate on lathe. 2.6 Drilling machine. i. Types. ii. Working principle (using block diagram). 2.7 Redial drilling machining. i. Constructional features. ii. Kinematics (drive, spindle speeds, feed mechanism, radial movement, etc.) constructional sketch, working, and use. iii. Detailed specifications. iv. Accessories- types, constructional sketch, working and applications. v. Tool holding and setting methods. vi. Operations performed. vii. Work holding devices- constructional sketch, working and applications. 2.8 Metal removal rate (MRR) –method to calculate on drilling machine.

Unit – III Basic machine tools- II

3.1 Milling machine. i. Types. ii. Working principle (using block diagram). 3.2 Plain horizontal milling machining. i. Constructional features. ii. Kinematics (drive, spindle speeds, feed mechanism, table movement, etc.) constructional sketch, working, and use. iii. Detailed specifications. iv. Operations performed. 3.3 Milling cutters-types and applications. 3.4 Up milling and down milling- concept, advantages, disadvantages and 3.5 Indexing-dividing head- constructional sketch, working, and use. 3.6 Simple, differential and compound indexing methods with simple numerical. 3.7 Work holding

devices- constructional sketch, working and applications. 3.8 Metal removal rate (MRR) – concept and method to calculate on milling.

Unit – IV Basic machine tools-III

4.1 Shaping machine. i. Types. ii. Working principle (using block diagram). iii. Constructional features and detailed specifications. iv. Quick return mechanisms- kinematic sketch, working and advantages. v. Operations performed. vi. Work holding devices- constructional sketch, working and applications. 4.2 Slotting machine. i. Types. ii. Working principle (using block diagram). iii. Constructional features and detailed specifications. iv. Operations performed. v. Work holding devices- constructional sketch, working and applications. 4.3 Planning machine. i. Types. ii. Working principle (using block diagram). iii. Constructional features and detailed specifications of double column planner iv. Operations performed. v. Work holding devices- constructional sketch, working and applications.

Unit – V Cutting tools and tool holders

5.1 Various cutting tool materials, their compositions and properties. 5.2 Alloying elements in tool materials and their effects. 5.3 Carbide inserts: i. Designation method for turning, milling and drilling (As per ISO). ii. Need. iii. Benefits. 5.4 Tool holders for carbide inserts: i. Designation method for turning, milling and drilling (As per ISO). ii. Need. iii. Benefits. iv. Mounting and replacement methods of carbide insert. 5.5 General cutting parameters for various cutting tool materials (HSS and Carbide) and work piece materials.(low carbon steel, high carbon steel, stainless steel, gunmetal, cast iron and aluminum). 5.6 Cutting tool angles and their functions. 5.7 Various cutting tools (with tool geometry, nomenclature, tool materials, sketch/drawing of each, ISO/BIS standards) used for various operations on lathe, milling and drilling machines. i. Single point cutting tool. ii. Plain milling cutter. iii. Side and face milling cutter. iv. Centre drill. v. Twist drill. 5.8 Functions and types of chip breakers. 5.9 Tool life, tool wear and machinability, factors affecting them. 5.10 Re-sharpening of cutting tools specified at 5.7 above.

Unit – VI Automates

6.1 Capstan and turret lathe: i. Constructional features and working principle. ii. Functions and applications. iii. Difference between capstan and turret lathe. iv. Preparation of tool layout. v. Merits and demerits. vi. Turret lathe in comparison with basic centre lathe. vii. Work holding devices. 6.2 Single spindle Automats: i. Need. ii. Constructional features. iii. Working principle and applications. iv. Collets-constructional features and applications. 6.3 Introduction to multi spindle automates and special purpose automates.

DE ME SEM-4 Detail Syllabus of Thermal Engineering - 1 (3341902)

TEACHING AND EXAMINATION SCHEME:

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
3	0	2	3	70	30	20	30	

Unit – I Two phase system

1.1 Concept of two phase system. 1.2 Formation of steam, its various phases, definition and representation of wet steam, dry steam, saturated steam and superheated steam on PV, T-s and H-s diagram. 1.3 Concept and determination of dryness fraction and degree of superheat. 1.4 Concept and determination of latent heat, sensible heat, enthalpy, entropy and specific volume of steam. 1.5

Use of Steam tables and Mollier chart- (Heat Entropy Chart). 1.6 Numerical examples based on above.(1.1 to 1.5). 1.7 Throttling process. 1.8 Methods of measurement of steam quality, Calorimeters- Bucket, Separating, Throttling and Combined calorimeters. (No numerical Problems).

Unit- II Boilers, mountings and accessories

2.1 Steam boiler-concept, definition as per Indian Boilers Regulation (IBR), functions, features and classification. 2.2 Working, merits and demerits of following low pressure steam boilers: i. Simple vertical boiler. ii. Lancashire boiler. iii. Cornish boiler. iv. Cochran boiler. v. Babcock and Wilcox water tube boiler. vi. Packaged boiler. vii. Waste heat recovery boiler. 2.3 Boiler mountings and accessories-functions, working and location on boilers. 2.4 Boiler draught system-concept and classification. 2.5 Boiler performance – parameters, evaporative capacity, equivalent evaporation, efficiency, heat balance sheet, simple numerical examples based on these. 2.6 Concept of fluidized bed combustion boilers. 2.7 Maintenance, inspection and safety precautions in boiler house (As per IBR), check list in boilers.

Unit – III Steam prime movers

3.1 Concept and classification of prime movers. 3.2 Steam nozzles-types, working and applications. Mass and velocity of steam discharge through nozzle (No derivation). Simple examples. 3.3 Steam turbine – concept and classification. Impulse and reaction turbines (constructional and materials details.)-working and differences. 3.4 Compounding of steam turbine: i. Need. ii. Pressure compounding. iii. Velocity compounding. iv. Pressure velocity compounding.

Unit – IV Steam condensers and cooling towers

4.1 Elements of a steam condensing plant, concept, function and classification of condensers. 4.2 Jet condensers and surface condensers- constructional sketch, working and differences 4.3 Vacuum efficiency and condenser efficiency of condensers- simple numerical example. 4.4 Classification, function and working of cooling towers.

Unit – V Air compressors

5.1 Air compressor-concepts, functions, classification and applications. 5.2 Working of reciprocating air compressor and rotary air compressors. 5.3 Single stage air compressor and multistage air compressor: i. Working. ii. Inter-cooling & after cooling. 5.4 Power required and efficiency of reciprocating air compressors-single and two stages, simple numerical examples. 5.5 Concept of screw compressors for oil free air.

Unit – VI Heat transfer

6.1 Various modes of heat transfer. 6.2 Conduction heat transfer- Fourier's law- explanation (No Cartesian or other equation derivation), thermal conductivity, heat transfer through a plain wall, composite wall and cylinder. 6.3 Convection heat transfer, Newton's law of convection, Free and force convection, coefficient of convection. 6.4 Radiation heat transfer, Blackbody concept, emissivity, refractivity, absorptivity, Stefan and Boltzmann's law. 6.5 Define thermal conductivity. 6.6 Need, types, properties and applications of insulating materials in various industries. 6.7 Difference between hot and cold insulation. 6.8 Over all heat transfer coefficient.6.9 Simple numerical examples based on above. 6.10 Heat exchanger: introduction, types and applications- Logarithmic Mean Temperature Difference (LMTD) concept- (No derivation & no numerical examples).

DE ME SEM-4 Detail Syllabus of Theory of Machine (3341903)

TEACHING AND EXAMINATION SCHEME:

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
4	0	2	6	70	30	20	30	

Unit – I Introduction

1.1 Theory of machines: introduction, need, scope and importance in design and analysis. 1.2 Kinematics, kinetics and dynamics-concept and examples. 1.3 Basic terminology related to machines and mechanisms. 1.4 Development of different mechanisms and its inversions like four bar chain mechanism , slider crank mechanism, double slider crank mechanism, etc.

Unit- II Velocity and acceleration diagram

2.1 Basic concept used in solving velocity and acceleration problems.

2.2 Approach to solve velocity and acceleration related to mechanisms using Relative velocity method for single slider crank mechanism and Four bar chain mechanism. 2.3 Klein's construction for single slider cranks mechanism.

Unit – III Cam and cam profile

3.1 Introduction, functions and types of cams and cam followers. 3.2 Types of motions and displacement for different types of cam and cam followers. 3.3 Construct different types of cam profiles

Unit – IV Friction

4.1 Concept and laws of friction. 4.2 Appreciate the role of friction in thrust bearing, pivot bearing and collars considering - Uniform pressure and Uniform wear condition. 4.3 Clutch: i. Functions. ii. Types with sketches and working. 4.4 Brakes: i. Functions. ii. Types with sketches and working. 4.5 Dynamometers- types and operational working principles.

Unit – V Power transmission

5.1 Introduction, need and modes of power transmission. 5.2 Types of power transmission. 5.3 Belt drive- types, terminology and standards/designation methods as per BIS/ISO. 5.4 Belt speed-co-efficient of friction, velocity ratios and slip. 5.5 Power transmitted by flat belt - tensions, centrifugal tensions, maximum tension, condition for transmitting maximum power and initial tension.(with derivations), numerical examples. 5.6 Merits and demerits of power transmission drives. 5.7 Gear trains-types, numerical examples and applications.

Unit – VI Flywheel and governor

6.1 Turning moment diagram: i. Concept. ii. Its use for different machines. iii. Fluctuations of energy. 6.2 Co-efficient of fluctuation of speed and energy. 6.3 Method to construct turning moment diagram, numerical examples. 6.4 Flywheel: functions and types. 6.5 Moment of inertia and mass calculation of flywheel-numerical examples. 6.6 Governors: terminology, types & functions.

Unit – VI I

Balancing and vibrations

7.1 Concepts and types of balancing. 7.2 Effects of unbalanced masses. 7.3 Balancing of revolving masses in same plane: i. Analytical and graphical methods to find balancing mass. ii. Numeric

examples. 7.4 Balancing of reciprocating masses. (No numerical examples). 7.5 Vibration: i. Terminology. ii. Effects. iii. Causes. iv. Remedies.

DE ME SEM-4 Detail Syllabus of Computer Aided Design (3341904)

TEACHING AND EXAMINATION SCHEME:

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	

Unit – I Fundamentals of CAD

1.1 Computer graphics & its terminology. 1.2 CAD definition, concept & need. 1.3 CAD process. 1.4 Functional areas of CAD. 1.5 Coordinate systems. 1.6 Geometric transformation-concept and types. 1.7 2 dimensional (2D) geometric transformation- translation, scaling, rotation and mirror with numeric examples.

Unit- II CAD Hardware

2.1 CAD Workstation-types, functions and configuration. 2.2 Input and output devices (including voice, gesture, 3 dimensional (3D) printer, etc)-types, configuration and applications

Unit – III Geometric modeling

3.1 Difference between 2D & 3D models. 3.2 Geometric modeling – concept, types, features and applications. 3.3 Solid modeling methods like Constructive Solid Geometry, Pure primitives & Boundary Representation 3.4 Feature base modeling-concept illustrative examples 3.5Parametric & non parametric modeling-concept, differences and illustration

Unit – IV 3D Modeling using AutoCAD

4.1 Introduction to AutoCAD-3D features and 2D commands overview. 4.2 3D primitives-types and defining parameters. 4.3 User coordinate system (UCS) and its options. 4.4 3D draw commands. 4.5 3D modify and editing commands. 4.6 3D viewing & views generation 4.7 Surface modeling commands.

Unit – V 3D parametric modeling

5.1 Introduction to parametric modeling software. (Any one from Creo, Unigraphics, CATIA, Solid Edge, Inventor etc). 5.2 Sketching interfacing overview. 5.3 3D working plane introductions. 5.4 3D modeling. 5.5 Assembly modeling. 5.6 Views generation.

DE ME SEM-4 Detail Syllabus of Metrology & Instrumentation (3341905)

TEACHING AND EXAMINATION SCHEME:

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
4	0	4	8	70	30	40	60	

Unit – I Linear and angular measurement

1.1 Inspection, quality and quality control-definitions and differences. 1.2 Define accuracy, precision and error. 1.3 Principle of vernier scale and least count. 1.4 Surface plates-types, important features, standards/important sizes, applications and precautions in use. 1.5 Types, constructional sketch, major parts and their functions, least count , measuring methods and measurement illustration (for e.g. 12.48mm)of: i. Vernier caliper. ii. Micrometer. iii. Telescopic gauge. iv. Height gauge. v. Depth gauge. 1.6 Slip gauge-types, applications, and wringing method.1.7 Sketch, major parts and their functions, least count , measuring methods and measurement illustration of: i. Bevel Protector. ii. Sine bar. iii. Angle gauges. iv. Angle Dekkor v. Spirit level. vi. Clinometers. vii. Auto collimator. 1.8 Calibration – concept and need.

Unit- II Measurement of geometrical tolerances

2.1 Dial indicators/gauge-types, constructional sketch and applications. 2.2 Definition, symbol and measuring methods of: i. Straightness. ii. Flatness. iii. Squareness. iv. Parallism. v. Perpendicularity. vi. Roundness. vii. Concentricity. viii. Cylindricity. ix. Run out and ovality.

Unit – III Measurement of surface roughness

3.1 Terminology used in connection with surface finish. 3.2 Comparison methods to inspect surface finish-concept and applications. 3.3 Direct instrument measurement methods-types and concepts. 3.4 Construction, working and applications of Talysurf surface roughness tester and Tomlinson tester. 3.5 Centre line average and Root Mean Square systems of surface texture evaluation-terminology used, concept, equations and numerical examples. 3.6 Indication of various surface roughness characteristics with surface roughness symbols-interpretation.

Unit – IV Gear and thread measurement

4.1 Types of gears. 4.2 Forms of gear teeth-types and concept. 4.3 Gear tooth Terminology. 4.4 Sketch, major parts and their functions, least count, measuring methods and measurement illustration of gear tooth vernier. 4.5 Derivation and numerical example to measure gear tooth thickness using: i Gear tooth vernier. ii Constant chord method. iii Base tangent method. 4.6 Gear tooth profile measurement 4.7 Threads-classification, elements, specifications and forms. 4.8 Measurement of major and minor diameters. 4.9 Three and two wire method of measuring effective diameter of external thread-concept, terminology used, best wire size, derivation of equation and numerical example. 4.10 Thread micrometer-sketch, method to use and determination of dimension. 4.11 Pitch measurement methods.

Unit – V Limit gauges, Transducers and sensors

5.1 Limit gauges-classification, sketch and applications. 5.2 Comparators-concept, types and applications. 5.3 Instrumentation-introduction, performance characteristics. 5.4 Static characteristics of instruments. 5.5 Transducers-concept, classifications, physical quantities which can be measured, advantages and disadvantages. 5.6 Electrical transducers-types, working principles and applications. i Linear Variable Differential Transformer (LVDT) type pressure gauge.ii Resistance type. iii Capacitance type. iv Inductance type (LVDT). v Piezo-electric. 5.7 Sensors- classification and applications.

DE ME SEM-4 Detail Syllabus of Plant Maintenance and Safety (3341906)

TEACHING AND EXAMINATION SCHEME:

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
3	0	2	5	70	30	20	30	

Unit – I Fundamentals of maintenance engineering

1.1 Definition and aim of maintenance engineering. 1.2 Primary and secondary functions and responsibility of maintenance department. 1.3 Types of maintenance.
1.4 Types and applications of tools used for maintenance. 1.5 Maintenance cost & its relation with replacement economy. 1.6 Service life of equipment.

Unit- II Wear and Corrosion and their prevention

2.1 Wear- types, causes , effects 2.2 Wear reduction methods 2.3 Lubricants-types and applications. 2.4 Lubrication methods –General sketch, working and applications. i. Screw down grease cup. ii. Pressure grease gun. iii. Splash lubrication. iv. Gravity lubrication. v. Wick feed lubrication. vi. Side feed lubrication. vii. Ring lubrication. 2.5 Definition, principle and factors affecting the corrosion. 2.6 Types of corrosion. 2.7 Corrosion prevention methods.

Unit – III Fault tracing

3.1 Fault tracing-concept and importance. 3.2 Decision tree-concept, need and applications. 3.3 Sequence of fault finding activities, show as decision tree. 3.4 Draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipments like: i. Any one machine tool. ii. Pump iii. Air compressor. iv. Internal Combustion engine. v. Boiler. vi. Electrical motors. 3.5 Types of faults in machine tools and their general causes.

Unit – IV Periodic and preventive maintenance

4.1 Periodic inspection-concept and need. 4.2 Degreasing, cleaning and repairing schemes. 4.3 Overhauling of mechanical components. 4.4 Overhauling of electrical motor. 4.5 Common troubles and remedies of Electric motor. 4.6 Repair complexities and its use. 4.7 Definition, need, steps and advantages of preventive maintenance. 4.8 Steps/procedure for periodic and preventive maintenance of: i. Machine tools. ii. Pumps. iii. Air compressors. iv. Diesel generating (DG) sets. 4.9 Program and schedule of preventive maintenance of mechanical and electrical equipments. 4.10 Advantages of Preventive maintenance. 4.11 Repair cycle-concept and importance.

Unit – V Industrial safety

5.1 Accident - causes, types, results and control. 5.2 Mechanical and electrical hazards-types, causes and preventive steps/procedure. 5.3 Describe salient points of Factories act 1948.for health and safety-, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc. 5.4 Safety colour codes. 5.5 Fire prevention and fire fighting, equipment and methods.

Unit – VI Recovery, reconditioning and retrofitting

6.1 Definition of recovery, reconditioning and retrofitting. 6.2 Methods of recovery and their applications. 6.3 Selection criteria of recovery methods. 6.4 Reconditioning - process, features and advantages. 6.5 Retrofitting - concept, need and applications.

Unit – VII Installation, erection and commissioning of equipments

7.1 Design and planning of foundation. 7.2 Erection and commissioning of equipment. 7.3 Alignment and testing of equipment.