TECHNO INDIA UNIVERSITY
WESTBENGAL

EM 4, Sector V, Salt Lake, Kolkata-700091, West Bengal, India
Phone: +91 9836544416/17/18/19, Fax: +91 33 2357 1097

3-Year Diploma Engineering Curriculum and Syllabus for Mechanical Engineering (ME)

FOURTH SEMESTER

Course Code	Course Title	Contact Hrs. / Week			Credit
		L	T	P	
Theory					
TIUSD-401	Career Advancement & Skill Development-IV	2	1	0	3
TIUDME 401	Theory of Machines & Mechanism	3	1	0	4
TIUDME-402	Engineering Metrology	2	1	0	3
TIUDME-403	Heat Power - II	3	1	0	4
TIUDME-404	Manufacturing Processes	2	1	0	3
TIUDME-405	Engineering Materials	2	1	0	3
Practical					
TIUDME-491	Metrology Lab	0	0	3	2
TIUDME-492	Machine Drawing & CAD	0	0	3	2
TIUDME-493	Mechanical Engineering Workshop – II	0	0	3	2
Sessional					
TIUCSL-481	Entrepreneurship & Skill Development-IV	0	0	2	2
Total Credits					28

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Theory of Machines & Mechanism

TIUDME 401

L-T-P: 3-1-0 **Credit: 4**

Module 1 Fundamentals and types of Mechanisms and velocity in Mechanism

1.1 Kinematics of Machines: - Definition of Statics, Dynamics, Kinematics, Kinetics, Kinematic link, Kinematic Pair and its types, constrained motion and its types, Kinematic chain and its types, Mechanism, machine and structure, inversion of mechanism.

1.2 **Inversions of Kinematic Chain:**

1.2.1 Inversion of four bar chain- four bar chain mechanism, coupled wheels of Locomotive & Pantograph.

1.2.2 Inversion of Single Slider Crank chain- Slider Crank mechanism, Rotary I.C. Engines mechanism, Whitworth quick - return mechanism, Crank, Slotted lever quick return mechanism, hand- pump.

1.2.3 Inversion of double slider crank chain- double slider crank mechanism, Scotch Yoke mechanism & Oldham's coupling

1.3 **Velocity of a point in mechanism:**
Determining the velocity of a point in 4-bar chain mechanism & slider- Crank mechanism by relative velocity method and instantaneous centre method (use graphical method only)

Module 2 Cams and Followers:

2.1 Concept, definition and application of Cams and Followers.

2.2 Classification of Cams and Followers.

2.3 Different follower motions and their displacement diagrams like uniform velocity, SHM, uniform acceleration and Retardation.

2.4 Drawing of profile of radial cam with knife-edge and roller follower with and without offset with reciprocating motion (graphical method).

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Module 3 Power Transmission:

3.1 Types of Drives – Belt, Chain, Rope, Gear drives & their comparison.

3.2 Belt Drives - flat belt, V– belt & its applications, material for flat and V-belt, angle of lap, belt length. Slip and creep. Determination of velocity ratio, ratio of tight side and slack side tension, centrifugal tension and initial tension, condition for maximum power transmission (Simple numerical on flat belt drive)

3.3 Gear Drives – Spur gear terminology, types of gears and gear trains, their selection for different application, train value & Velocity ratio for compound, reverted and simple epicyclic gear train, methods of lubrication, Law of gearing. (Simple problems on gear train)

Module 4 Flywheel and Governors:

4.1 Flywheel - Concept, function and application of flywheel with the help of turning moment diagram for single cylinder 4-Stroke I.C. Engine (no Numericals). Coefficient of fluctuation of energy, coefficient of fluctuation of speed and its significance.(simple problems on determination of mass of fly wheel using crank effort diagram)

4.2 Governors - Types, concept, function and application & Terminology of Governors. (simple problems on watt & porter governor)

4.3 Comparison between Flywheel and Governor.

Module 5 Brakes, Dynamometers, Clutches & Bearings:

5.1 Function of brakes and dynamometer, types of brakes and Dynamometers, comparison between brakes and dynamometer.

5.2 Construction and working of i) shoe brake, ii) Band Brake, iii) Internal expanding shoe brake iv) Disc Brake.

5.3 Concept of Self Locking & Self energizing brakes.

5.4 Numerical problems to find braking force and braking torque for shoe & band brake.

5.5 Construction and working of i) Rope Brake Dynamometer, ii) Hydraulic Dynamometer, iii) Eddy current Dynamometer.

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5.6 Clutches- Uniform pressure and Uniform Wear theories
5.7 Function of Clutch and its application, Construction and working of i) Single plate clutch, ii) Multiplate clutch, iii) Centrifugal Clutch iv) Cone clutch v) Diaphragm clutch. (Simple numerical on single and Multiplate clutch).

5.8 Bearings – i) Simple Pivot, ii) Collar Bearing, iii) Conical pivot. Torque & power lost in friction (no derivation). Simple numerical.

Module 5 Balancing & Vibrations:

6.1 Concept of balancing. Balancing of single rotating mass. Graphical method for balancing of several masses revolving in same plane & different plane.

6.2 Concept and terminology used in vibration, causes of vibrations in machines, their harmful effects and remedies.

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Engineering Metrology

TIUDME 402

L-T-P: 2-1-0 **Credit: 3**

G R O U P – A

Module 1 Limits, Fits, Tolerances and Gauges

Tolerances, Selective Assembly, Interchangeability, Limits Of Size, Allowances, Clearances, Interference, IS 919- 1993 , Fits, Selection Of Fits, Numerical Problems On Limits Of Size And Tolerances, , Taylor's Principle, Gauge Design, hole and shaft basis system, Plain Plug Gauge IS: 3484 -1966, Plain Ring Gauge IS: 3485 -1972, Snap Gauge IS: 3477 -1973.

Module 2 Linear Measurement

Description, working principle, method of reading, least count for Vernier Calipers, Micrometers(outside micrometer, Inside Micrometer, Stick Micrometers), depth gauge & Height Gauge, Feeler gauge, Slip Gauges (category, use, Selection of Slip Gauges for setting particular dimension**)**

Module 3 Angular Measurement

Concept, Instruments for Angular Measurements, construction, Working principle and Use of Universal Bevel Protractor, Sine Bar, Spirit Level, Principle of Working of Clinometers, Angle Gauges (With Numerical on Setting of Angle Gauges)

Module 4 Comparators

Definition, Classification, use of comparators, Working principle of different type of comparators like mechanical comparator (Dial indicator, Sigma comparator), Pneumatic comparator, Electrical Comparators**,** Optical Comparators**,** characteristics of good comparator, Relative advantages and disadvantages.

G R O U P – B

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Module 5 Screw thread Measurements

Terminology of thread, Pitch errors, Measurement of different elements such as major diameter, minor diameter, effective diameter, pitch & thread angle, Working principle of floating carriage dial micrometer, Screw Thread Micrometer, pitch measuring m/c, Two wire method, thread gauge (plug gauge, ring gauge & snap gauge)

Module 6 Gear Measurement and Testing

Analytical and functional inspection, Rolling test, Measurement of tooth thickness (constant chord method), gear tooth Vernier, Errors in gears such as backlash, runout, composite.

Module 7 Measurement of surface finish

Primary and secondary texture, Sampling length, Lay, terminology as per IS 3073- 1967, direction of lay, Sources of lay and its significance, CLA, Ra, RMS, Rz values and their interpretation, Symbol for designating surface finish on drawing, Various techniques of qualitative analysis, Working principle of stylus probe type instruments.

Module 8 Machine tool testing

Parallelism by dial indicator, Straightness testing by straight edge, spirit level & Autocollimators, flatness testing by dial gauge, level or Autocollimators, optical flats Squareness Testing - by dial indicator, optical square, indicating method., alignment testing of lathe machine tool as per IS standard procedure.

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L-T-P: 3-1-0 **Credit: 4**

GROUP – A

Module 1 BOILERS (STEAM GENERATOR)

1.1 Classification of Boilers.
1.2 Fire Tube & Water Tube Boilers with example, working principle, difference, applications.

1.3 Construction & working principle of Cochran, Babcock and Wilcox and La-Mont Boilers.

1.4 Definition of Boiler Mountings and Accessories, important names of Boiler Mountings and Accessories and their functions.

1.5 Basic conception and comparison of Stoker fired, Fluidized Bed and Pulverised Fuel Boilers.

1.6 Boiler Performance (Simple numerical on Boiler Performance). Boiler Draught, Classification and comparison of boiler draught and Calculation of chimney heights (Simple numerical related to chimney heights calculation)

1.7 Necessity of boiler feed water treatment.

1.8 Modern high pressure boiler & its characteristics.

Module 2 STEAM POWER CYCLES

2.1 Reversible Cycle.

2.1.1 Carnot Gas Power Cycle and Carnot Vapour Power Cycle with representation of the same on P-V & T-S diagrams.

2.1.2 Deduction of Thermal Efficiency of Carnot Power Cycle (Simple numerical on Carnot Power Cycle with steam).

2.1.3Impracticability of Carnot Cycle in actual cases

2.2.0 Rankine Cycle with & without feed pump work and representation of the same on P-V, T-S & H-S diagrams

2.2.1 Comparison between Carnot and Rankine Cycles.

2.2.2 Definition of Thermal Efficiency, Work Ratio and Specific Steam Consumption.

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2.3.0 Basic Principle, representation on P-V, T-S & H-S diagrams, labelled schematic flow diagram and utility of the following cycles: (No numerical)

2.3.1 Modified Rankine Cycle.

2.3.2 Simple Reheat Cycle.

2.3.3 Simple Regenerative Cycle.

2.3.4 Actual Reheat-Regenerative Cycle.

Module 3 STEAM CONDENSER

3.1.0 Working Principle, Purpose of using and Classification of Steam Condensers.
3.1.1 Comparison between Surface Condenser and Jet Condenser.
3.1.2 Dalton's Law Of Partial Pressure as applicable to Condenser.
3.1.3 Definition of Condenser Vacuum, Vacuum Efficiency and Condenser Efficiency. (No numerical)
3.1.4 Sources of air leakage in Steam Condenser.
3.2.0 Working Principle, Purpose of using and Classification (Natural Draught and Mechanical Draught) of Cooling Towers.
3.2.1 Labelled schematic flow diagram of Cooling Water Circulation of a Surface Condenser with and without Cooling Tower.

GROUP – B

Module 4 AIR COMPRESSER

4.1.0 Uses of Compressed Air
4.1.1 Working Principle and Classification of Air Compressors.
4.1.2 Definition of Compression Ratio, Compressor Capacity, Free Air Delivery and Swept volume.
4.2.0 Reciprocating air compressor
4.2.1 Construction and Working Principle of Single Stage and Two Stage Compressor.
4.2.2 Volumetric Efficiency, Isothermal Efficiency & Mechanical Efficiency. (Simple numerical on single stage compressor)
4.2.3 Advantages of Multi Staging.
4.3.0 Rotary Compressor
4.3.1 Construction and Working Principle of Screw, Lobe, Vane and Centrifugal Compressors. (No numerical)
4.3.2 Comparison and Applications of Reciprocating and Rotary Compressors.
4.4.0 Purification of Air to remove Oil, Moisture and Dust.
4.5.0 Methods of energy saving in Air Compressors.

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Module 5 REFRIGERATION & AIR CONDITIONING

5.1.0 Definition of Refrigeration, Tonne of Refrigeration (Unit of Refrigeration) and Coefficient of Performance (COP) of Refrigerator & Heat Pump.
5.1.1 Refrigerant, desirable properties of a refrigerant and common commercial refrigerants & their suitability of use.
5.1.2 **Air Refrigeration:**

Basic Principle, representation on P-V & T-S diagrams, labeled schematic flow diagram Bell Coleman Cycle (Reversed Joule Cycle). (Simple numerical)

5.1.3 **Vapour Compression Refrigeration:**
Basic Principle, representation on P-V, P-H & T-S diagrams, labelled schematic flow diagram and function of components of Ideal Vapour Compression Refrigeration Cycle. (No numerical)

5.1.4 **Application of Refrigeration System:**

Water Cooler, Refrigerator, Ice Plant and Cold Storage (Labelled schematic lay-out only)

5.2.0 Basic concept of Psychrometry including the following: Dry air & Moist air, Saturated air & Unsaturated air. Dry-bulb temperature, Wet-bulb temperature, Dew-point temperature and Psychrometer. Relative Humidity, Specific Humidity and Degree of saturation. Partial Pressure of Air & Vapour and Enthalpy of Moist Air, Psychrometric Chart. (No numerical)

5.3.0 Definition of Air-Conditioning and classification of Air- Conditioning Systems.
5.4.0 Schematic lay-out and representation on Psychrometric Chart of the following Air-Conditioning Processes: Sensible heating and cooling, Humidification and dehumidification, Humidification with heating and cooling, Dehumidification with heating and cooling &Mixing of two air streams (No numerical).

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L-T-P: 2-1-0 **Credit: 3**

GROUP – A

Module 1 INTRODUCTION

1.1 Classification of manufacturing processes: Shaping process, joining process & Finishing process

Module 2 Forging

2.1 Introduction of Hot Working & Cold Working. Examples
2.2 Forging Processes – Drop forging, Upset forging, Die forging or press forging.
2.3 Types of dies - Open Die, Closed Die(Single Impression and Multiimpression) Closed die Forging operations - Fullering, Edging, Bending, Blocking, Finishing
2.4 Forgeable material and forgeability, Forging temperature, Grain flow in forged parts**,** Types of Presses and hammers.

Module 3 Rolling and Extrusion

3.1 Principles of rolling and extrusion.
3.2 Hot and cold rolling.
3.3 Types of rolling mills: 2 Hi, 3 Hi & 4 Hi mills.
3.4 Different rolled sections.
3.5 Methods of extrusion – Direct, Indirect, backward & impact Extrusion, Hot extrusion, Cold extrusion
3.6 Advantages, disadvantages & applications of rolling & extrusion.

Module 4 Press working

4.1 Types of presses and Specifications.
4.2 Press working operations - Cutting, bending, drawing, punching, banking, Notching, lancing, piercing, coining, embossing.
4.3 Die set components.- punch and die shoe, guide pin, bolster plate, stripper, stock guide, knockout.
4.4 Punch and die Clearances for blanking and piercing, effect of clearance.

GROUP – B

Module 5 Shaping & planning

2.0 Kinematic structure, working principle & application of Shaping machine

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2.1 Application of planner machine
2.2 Specification of shaper machine, Different operations like making of flat surface, vertical surface, inclined surface, Slotting, pocketing, T-slot cutting, Veeblock & formed surface (grooving & straight tooth cutting for spur gear)
2.3 Cutting tools, Cutting parameters& machining time calculations.

Module 6 Milling and gear cutting

4.0 Kinematic structure, working principle & application of Milling machine,
4.1 Milling operations – side and face milling, straddle milling, form milling, gang milling, end milling, face milling, T- slot milling, slitting.
4.2 Cutting parameters & machining time calculation for plain milling operation
4.3 Gear cutting on milling machine –Dividing head and Indexing methods
4.4 Gear hobbing: Principle of operation, Advantages And limitations. Hobbing techniques – climb and conventional,
4.5 Gear shaping - Principle of operation, advantages, disadvantages,

Module 7 Grinding

5.1 Classification of machines , abrasive types & uses
5.2 Grinding wheel composition (Bond, grade ,grit & structure), types and shapes, Designation of a grinding wheel (specification), Factors selecting of grinding wheel
5.3 Types of Grinding operations: Cylindrical, Surface & Centre less grinding
5.4 Balancing, truing & dressing.

GROUP – C

Module 8 Casting

8.1 Patterns - Material used, types, Patterns allowances, Cores, Core allowances. Core prints.
8.2 Moulds - Mould materials, Types of sand, Sand moulding, Pit moulding, machine molding.
8.3 Melting practice - Types of furnaces with specific application Cupola furnace, Electric arc furnace
8.4 Green sand mould making process
8.5 Special casting processes: die casting, centrifugal casting, investment casting, Shell moulding
8.6 Casting defects & its remedies.

Module 9 Welding

9.1 Classification.
9.2 Gas welding techniques.

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9.3 Types of welding flames.
9.4 Arc Welding – Principle, Equipment, Applications

Engineering Materials

TIUDME 405

L-T-P: 2-1-0 **Credit: 3**

GROUP – A

Module 1 Mechanical Engineering Materials and their Properties

1.1 Introduction, Classification and Application of Engineering materials I.S. specification of materials like plain carbon steel, Grey Cast iron, low alloy steels & bearing Materials.

1.2 Properties of metals- Physical Properties – Structure, Density, Melting point. Mechanical Properties –hardness, hardenability, brittleness, fatigue, thermal conductivity, electrical conductivity, thermal coefficient of linear expansion

1.3 Introduction to Corrosion, types of Corrosion, Corrosion resisting materials

Module 2 Ferrous Metals and Alloys

2.1 Characteristics and application of ferrous metals

2.2 Phase equilibrium diagram for Iron and Iron Carbide.

2.3 Flow diagram for production of Iron and Steel, Classification, composition and uses of cast iron

2.4 Classification, composition and application of low carbon steel, medium carbon steel and high carbon steel with their chemical composition. Effect of sulphur, silicon and phosphorous on plain carbon steel

2.5 Alloy Steels: - Low alloy steel, high alloy steel, tools steel & stainless steel. Effect of various alloying elements such as – Chromium, nickel, manganese, molybdenum, tungsten, vanadium

2.6 Tool Steels (properties & applications): - High speed Steels (HSS), Hot & cold Working dies, shear, punches.

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2.7 Magnetic materials: - Properties & Applications of commonly used magnetic materials (Permanent magnets and temporary magnets).

2.8 Special Cutting Tool Materials (Properties & Applications): Diamond, Stelites, Tungsten Carbide & Ceramics.

GROUP – B

Module 3 Non Ferrous Metals and Alloys

3.1 Properties, applications of Copper alloys (naval brass, muntz metal, Gun metal & bronzes), Aluminium alloys (Y-alloy & duralumin) & bearing materials like white metals, leaded bronzes & copper lead alloys.

3.2 Desired properties of bearing materials.

Module 4 Heat Treatment of Steels

4.1 TTT Diagram

4.2 Introduction to Heat treatment processes such as Annealing, subcritical annealing, Normalizing, Hardening, Tempering (Austempering & Martempering) - Principle, Advantages, limitations and applications.

4.3 Surface Hardening - Methods of surface hardening, i) case hardening ii) Flame Hardening, iii) Induction Hardening, iv) Nitriding, v) Carburizing Principle, advantages, limitations and applications.

GROUP – C

Module 5 Non Metallic Materials

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5.1 Polymeric Materials – Introduction to Polymers- types, characteristics, properties and uses of Thermoplastics, Thermosetting Plastics & Rubbers.

5.2 Thermoplastic Plastics – Uses of ABS, Acrylics, Nylons and Vinyls.

5.3 Thermosetting Plastics – Characteristics and uses of polyesters, Epoxies, Melamines & Bakelites.

5.4 Rubbers – Neoprene, Butadiene, Buna & Silicons – Properties & applications.

5.5 Properties and applications of following Engineering Materials – Ceramics, Abrasive, Adhesive and Insulating materials such as Cork, Asbestos, Thermocole and Glass Wool.

5.6 Introduction to Composite Materials – Properties & Applications of Laminated & Fiber reinforced materials.

Module 6 Powder Metallurgy

6.1 Advantages, limitations and applications of Powder Metallurgy for engineering products.

6.2 Brief Description of Process of Powder Metallurgy – Powder making, blending, compacting, sintering, infiltration & impregnation.
6.3 Applications of Powder metallurgy for tungsten carbide tip tools & porous bearing.

Module 7 Nondestructive Testing

7.1 Importance of Non-destructive testing, Difference between Destructive and Nondestructive testing.

7.2 Nondestructive testing methods – Radiography (X-Ray & Gamma Ray), Ultrasonic crack detection, Dye penetrant test, Magnaflux test – Comparison & applications.