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

FIFTH SEMESTER

Course Code	Course Title	Contact Hrs. / Week			Credit
		L	T	P	
Theory					
TIUSD-501	Career Advancement & Skill Development-V	2	1	0	3
TIUDME 501	Fluid Mechanics & Machinery	3	1	0	3
TIUDME-502	Advanced Manufacturing Processes	2	1	0	3
TIUDME-503	Concepts of Heat Transfer	2	1	0	3
TIUDME-504	Heat Power - III	2	1	0	3
TIUDME-505	Elective - I (any one) *	2	1	0	3
Practical					
TIUDME-591	Fluid Mechanics and Machinery Laboratory	0	0	3	2
TIUDME-592	Heat Transfer Laboratory	0	0	3	2
TIUDME-593	Advanced Manufacturing Processes Lab	0	0	3	2
TIUDME-593	Vocational Training	0	0	3	2
Sessional					
TIUCSL-581	Entrepreneurship & Skill Development-V	0	0	2	2
Total Credits					28

List of Papers for Elective I:

a) Automobile Engineering
b) Mechatronics
c) Power Plant Engineering
d) Tool Engineering

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Fluid Mechanics & Machinery

TIUDME

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

GROUP – A

Module 1 Properties of fluid

1.1 Density, Specific gravity, Specific Weight, Specific Volume
1.2 Dynamic Viscosity, Kinematics Viscosity, Surface tension, Capillarity
1.3 Vapour Pressure, Compressibility

Module 2 Fluid Pressure & Pressure Measurement

2.1 Fluid pressure, Pressure head, Pressure intensity.
2.2 Concept of absolute vacuum, gauge pressure, atmospheric pressure, absolute pressure.
2.3 Simple and differential manometers, Bourden pressure gauge.
2.4 Concept of Total pressure on immersed bodies(flat vertical, flat inclined), center of Pressure, Pr. Distribution diagram.
Note: Numerical on Manometers, Total Pressure & Centre of pressure.

GROUP – B

Module 3 Fluid Flow

3.1 Types of fluid flows: steady-unsteady, uniform-non-uniform, laminar turbulent.
3.2 Continuity equation
3.3 Bernoulli's theorem
3.4 Venturimeter – Construction, principle of working, Coefficient of discharge, Derivation for discharge through venturimeter.
3.5 Orifice meter – Construction, Principle of working, hydraulic coefficients, Derivation for discharge through Orifice meter
3.6 Pitot tube – Construction, Principle of Working
Note: - Numerical on Venturimeter, orifice meter, pitot tube.

Module 4 Flow through Pipes

4.1 Laws of fluid friction (Laminar and turbulent)
4.2 Darcy's equation and Chezy's equation for frictional losses.

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4.3 Minor losses in pipes
4.4 Hydraulic gradient and total gradient line.
4.5 Hydraulic power transmission through pipe
Note: Numerical to estimate major and minor losses.

GROUP – C

Module 5 Impact of jet

5.1 Impact of jet on fixed vertical, moving vertical flat plates.
5.2 Impact of jet on curved vanes with special reference to turbines & pumps
Note - Simple Numerical on work done and efficiency.

Module 6

A**] Centrifugal Pumps**

6.1 Construction , principle of working and applications
6.2 Types of casings and impellers.
6.3 Concept of multistage
6.4 Priming and its methods, Cavitation
6.5 Manometric head, Work done, Manometric efficiency, Overall efficiency, NPSH
Note: - Numerical on calculations of overall efficiency and power required to drive pumps.

B] Reciprocating Pump

6.6 Construction, working principle and applications of single and double acting reciprocating pumps.
6.7 Concept of Slip, Negative slip, Cavitation and separation
6.8 Use of Air Vessel.
6.9 Indicator diagram with effect of acceleration head & frictional head.
Note: - No Derivations and Numerical on reciprocating pumps.

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ADVANCED MANUFACTURING PROCESS

TIUDME

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

Module 1 Nontraditional machining processes

1.1 Electrical discharge Machining. Principle of working, Setup of EDM, Dielectric fluid, tools (electrodes), Process parameters, Output characteristics, Applications e.g. microhole drilling, curve hole drilling.
1.2 Wire cut EDM - Principle of working, Setup of WEDM, controlling Parameters, Applications.
1.3 Laser Beam Machining. Physical principle of Laser, Laser action in ruby rod, Types of Lasers. Set-up for LBM, Characteristics, controlling Parameters, Applications, Application of Laser Beam for Welding (LBW)
1.4 Principle of working & Applications of ECM & USM

Module 2 Jigs and Fixtures

Introduction. Difference between jig and fixture Different components of Jig/ fixture
3-2-1 principle of location, Types of locators and clamping devices.
General principles of jig/fixture design.
Types of jigs and fixtures

Module 3 CNC Machine Tools

Concept of NC & CNC, CNC Turning Centre, Advantages & Disadvantages of CNC machine tools, Applications of NC/CNC Machine, Classification of CNC M/C Tools (Based on motion type, based on control loops, based on axis, based on power supply), Different components of CNC machine tools & their functions,

Components of CNC System (function & application): Stepper motor, Servo motor, Encoders (rotary & linear encoder), Recirculating ball screw, Automatic tool changer, Tool magazine. Work holding methods for turning centre (name & relative advantage & disadvantage), work holding methods for machining centre(name & relative advantage & disadvantage), steps in CNC process.

Part Programming: concept of part programming, reference point (Machine Zero, Program Zero, Part Origin), Axis identification of Turning Centre & Machining Centre, CNC Codes for manual part programming G – codes, M- Codes, Spindle speed control, feed rate control, Tool selection) part programming for turning centre using different codes & fixed cycles (canned cycle, do-loop & Subroutine) to get step, taper, plain & circular turning, facing, external threading & parting off operation. part programming for machining centre considering Cutter radius compensation, ramp on/off motion, tool

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offset and using different codes, canned cycles & subroutine for generating different milled surface. CNC part program verification.
Principles of computer aided part programming.

Module 4 FMS
Concept, Basic components of FMS (Different workstations, Automated material handling & storage system, computer control system), types of FMS layout, objectives of FMS, advantages & disadvantages of FMS.

Measurement & Control

TIUDME

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

GROUP – A

Module 1

Introduction to measuring system: Significance of Measurement, block diagram of a measuring system, Functional Elements Of measurement System, Classification of Instrument.

Introduction to Control system: Function of control system, Block diagram of open loop & closed loop system, Basic elements of closed loop system. 05

Example of measurement & control system for heating a room at specific temperature, Maintain a particular shaft speed.

Module 2

Displacement measurement: Working principle & use of Potentiometer, Differential transformer (LVDT & RVDT), capacitive element & Optical encoders.

Module 3

Speed Measurement: Mechanical tachometer, Electrical Tachometer, incremental optical encoder, Eddy current drag cup tachometer, Magnetic pickup tachometer, Stroboscopic tachometer, Photoelectric tachometer, non contacting electrical tachometer (inductive pick up & capacitive pick up)

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GROUP – B

Module 4

Temperature measurement: Pressure thermometer, Resistance Temperature Detector, Platinum resistance thermometer**,** Thermistors, Thermocouple, Quartz thermometer, radiation pyrometer, optical pyrometer.

Module 5

Flow Measurement: Variable area meter – Rotameter, Variable velocity meter – Anemometer, Special methods – ultrasonic flow meter, hot wire anemometer, electromagnetic flow meter.

Module 6

Miscellaneous Measurement: Acoustic Measurement: Characteristics of Sound, sound measuring system Sound level meter (using Piezo – electric crystal type microphone). Force measurement: Electromechanical method, strain gauge load cell. Shaft power measurement: Eddy current dynamometer, Strain gauge transmission dynamometer Strain measurement: strain gauge materials, resistance strain gauge – unbounded & bonded, wire gauge, foil gauge & semiconductor gauge, strain gauge rosettes.

Humidity measurement: Hair hygrometer, humistor hygrometer.

Liquid level: floats, differential pressure cell

Module 7

Control systems: Servomotor, mechanism & comparison of hydraulic, pneumatic, electronic control systems, proportional control action.

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POWER ENGINEERING

TIUDME

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

GROUP – A

Module 1 I.C. Engine and Pollution Control:

1.1 Basic Principle, representation on P-V & T-S diagrams and deduction of Thermal Efficiency of Otto Cycle, Diesel Cycle and Dual Combustion Cycle. (Simple numerical)
1.2 Classification of I.C. Engines.
1.3 Working Principle, Construction with function of components and Comparison of Two-Stroke and Four-Stroke (Petrol and Diesel) Engines.
1.4 Hypothetical & Actual Indicator Diagram of Two-Stroke and Four- Stroke (Petrol and Diesel) Engines.
1.5 Valve Timing Diagram of Two-Stroke and Four-Stroke (Petrol and Diesel) Engines.
1.6 Brief Description of I.C. Engine Combustion (SI & CI), Firingorder of Multi-cylinder I.C. Engine, Scavenging, Preignition, Detonation, Supercharging, Turbo-charging, Simple Carburetor, M.P.F.I. and Fuel Injection Pump.
1.7 Basic Concept of Governing of I.C Engine, Lubrication of I.C Engine and Cooling of I.C Engine.
1.8 Performance of I. C Engine – Indicator Power, Brake Power, Morse Test, Mechanical Efficiency, Thermal Efficiency, Relative Efficiency (Efficiency Ratio), Volumetric Efficiency, Specific Fuel Consumption and Heat Balance Sheet. (Simple numerical)
1.9 Pollutants in Exhaust Gases of Petrol and Diesel Engines, their effects on environment and possible ways of reducing the Pollutants in the Exhaust Gases. Effects on environment and possible ways of reducing the Pollutants in the Exhaust Gases

GROUP – B

Module 2 Nozzles / Diffusers and Steam Turbines:

2.1.0 **Nozzles / Diffusers:**
2.1.1 Working Principle, Classification and Application of Steam Nozzles & Diffusers.
2.1.2 Continuity Equation, Sonic Velocity and concept of Mach number.
2.1.3 Steady Flow Energy Equation for flow through Steam Nozzles. (Simple numerical)
2.1.4 Concept of Critical Pressure and Critical Pressure Ratio.

2.2.0 **Steam Turbines:**
2.2.1 Classification of Steam Turbines

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2.2.2 Working Principle, Construction with function of components of Simple Impulse Turbine and Simple Impulse-Reaction Turbine.
2.2.3 Velocity Diagrams, Work done, Power and Efficiency of Simple Impulse Turbine. (Simple numerical by using Graphical Method only)
2.2.4 Concept of Compounding of Steam Turbine.
2.2.5 Concept of Governing of Steam Turbine.

Module 3 Gas Turbine and Jet Propulsion:

3.1.0 **Gas Turbine:**
3.1.1 Basic Principle, representation on P-V & T-S diagrams and deduction of Thermal Efficiency of Brayton or Joule Cycle. (No numerical)
3.1.2 Classification and Applications of Gas Turbine.
3.1.3 Comparison, labelled schematic flow diagram and function of components of Closed Cycle & Open Cycle Gas Turbines.
3.1.4 Methods to improve thermal efficiency of gas turbine (Regeneration, Inter- Cooling, Reheating using T-S Diagram). (No analytical treatment)

3.2.0 **Jet Propulsion:**
3.2.1 Jet Propulsion – Basic Principles of Turbojet, Turbo Propeller & Ram Jet.
3.2.2 Rocket Propulsion- Solid Propellants and Liquid Propellants and Components & Function of Liquid Propellants Rocket Engine.

GROUP – C

Module 4 Hydraulic Turbines:
4.1 Classification of Hydraulic Turbines.
4.2 Construction and working principle of Pelton Wheel, Francis and Kaplan Turbine.
4.3 Draft Tubes – working principle and types, Concept of Cavitation in Turbines
4.4 Velocity Diagrams, Work done, Power and Efficiency of Pelton Wheel & Francis Turbine. (Simple numerical)
4.5 Basic concept of Governing of Turbine.
4.6 Specific Speed and Selection of turbine on the basis of head and discharge available.
4.7 Schematic Layout of Hydroelectric Power Plant.

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AUTOMOBILE ENGINEERING (ELECTIVE – I)

TIUDME

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

GROUP – A

Module 1 Introduction of Automobile

1.1 Classification of automobiles

1.2 Vehicle layout & types

1.3 Body construction - Types & Nomenclature of car body. Introduction to aerodynamic body shapes

1.4 Automobile market in India of "on road vehicles", major manufacturers, their products & their collaborations.

Module 2 Fuel supply system

2.1 Fuel feed system in S.I engine, types, gravity & pump feed system, layout of S.I engine fuel pump system, function of each components

2.2 Fuel mixing & circuit control system, carburetor, types, working principle of simple carburetor, requirement of air- fuel ratio, defects of carburetor & its remedy Circuits of carburetor, float, starting, idling, low speed, high speed & accelerating circuit Petrol injection system, types, layout & working principle of multi point fuel injection system, advantages & disadvantages

2.3 Fuel supply system in C.I engine, layout, components ,function, types, working & line diagram of common rail, individual pump system, fuel injectors, single orifice, multiple orifice.

GROUP – B

Module 3 Automobile Transmission

3.1 Clutch- necessity, construction & working of coil spring & diaphragm spring type clutch.

3.2 Gear Box- tractive effort and tractive resistance, types of G.B construction & working of constant mesh G.B., & synchromesh G.B., Epicyclic G.B., Torque converter, Overdrive, Transfer case

3.3 Final drive- necessity, construction & working of propeller shaft & differential.

3.4 Axle- Type of rear axles, front axles & their applications

Module 4 Control Systems

4.1 Steering system- Requirement of steering system, Construction and working of steering linkage. Steering gear box- construction & working of rack and pinion & recirculating ball type gearbox. Introduction to Power steering, Steering geometry- camber, caster, toe-in, toe-out, Kingpin inclination & their effects.

4.2 Brake system- construction & working of hydraulic & Pneumatic brakes. Comparison of disc & drum brake.

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GROUP – C

Module 5 Suspension systems, wheels & Tyres

5.1 Necessity & classification of suspension system.
5.2 Working & construction of Leaf spring, rigid axle suspension.
5.3 Introduction to air suspension
5.4 Construction & working of McPherson & wishbone, trailing link suspensions.
5.5 Construction & working of telescopic shock absorbers.
5.6 Construction & working of spoked wheel, disc wheel & light alloy cast wheel.
5.7 Types of rims, their construction & working.
5.8 Construction, working & comparison of radial, cross-ply and tubed, tubeless tyre & tyre specifications
5.9 Factors affecting tyre life
5.10Wheel Alignment and Balancing

Module 6 Automobile Electrical Systems & Body

6.1 Battery- working, construction & rating of battery.
6.2 Ignition system- construction & working of electronic and CDI ignition system.
6.3 Starting system- construction & working of starting motor.
6.4 Charging system- construction & working of alternator
6.5 Wiring system-harnessing & colour codes.
6.6 Lighting system-head light, tail light, indicator light & their circuits.
6.7 Gauges- construction & working of Fuel level gauge, oil gauge and water temperature gauge.
6.8 Use of microprocessor in automobile control systems

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Mechatronics (Elective I)

TIUDME

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

GROUP – A

Module 1

Concept of Mechatronics, Constituents of Mechatronics System, Application of Mechatronics in manufacturing, Introduction to Sensors & transducers, Principle of working and applications of Limit switches, proximity switches like inductive, capacitive and optical (deflecting and through beam type) , Thumb wheel switches , magnetic reed switches, Optical encoders-displacement measurement, rotary, incremental.

Module 2

Pneumatic, Hydraulic & Electrical Actuation System : Actuator – solenoids – on-off applications, latching, triggering, Types of relays- solid state, Types of motors – DC motors, DC brushless motors, AC motors, stepper motors, servo motors

Module 3

Computing Elements in Mechatronics:
8085 Microprocessor - Architecture, Pin configuration, working of microprocessor, and applications

Introduction to ICs used for interfacing such as – Programmable peripheral devices , USART, memory, keyboard, display – LCD,LED,I/O device, ADC, DAC.

8051 Microcontroller - Architecture, Pin configuration, working of microcontroller, Applications

Comparison of microprocessor and microcontroller, advantages and disadvantages

Programmable Logic Controller - Introduction, PLC definition, PLC block diagram, Difference between relay panel and PLC, power supply, input/output modules (analog, digital) concepts of sink/source, set/reset, latch/unlatch, advantages and disadvantages. Installation, troubleshooting and maintenance of PLC

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GROUP – B

Module 4

PLC Programming

Ladder diagrams and sequence listing, large process ladder diagram construction, flowcharting as a programming method, Basic PLC functions. Register basics, timer functions, counter functions Intermediate functions – Arithmetic functions, number comparison and number conversion functions Data handling functions- SKIP, Master control relay, Jump, Move, Block move, Table to register and register to table move functions. FIFO and LIFO functions, File Arithmetic and Logic function PLC digital bit functions and applications Sequencer functions and cascading of sequencers PLC matrix functions Discrete and analog operation of PLC, Networking of PLCs. PLC auxiliary commands and functions,

Module 5

Online, offline, stop/run modes of operations, uploading/downloading between PLC and PC, Introduction to SCADA and DCS

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POWER PLANT ENGINEERING (ELECTIVE-I)

TIUDME

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

GROUP – A

Module 1 Introduction to power plant

1.1 Power scenario in India
1.2 Types of power plants – Hydro, Nuclear, Thermal, Future trends in Power sector.

Module 2 Steam power plant

2.1 Layout of steam power plant, general features of selection of site
2.2 High pressure boilers – Construction and working of Sub-critical and Super-critical boilers.
2.3 Chronological development of Boilers [Stoker Fired, Pulverized Fuel Fired Boiler, Front Fired boilers, Tangentially Fired Boiler, Bottom Fired Boiler]
2.4 Coal and ash handling system- equipments for in plant handling of coal such as belt conveyor, screw conveyor, bucket elevator, Coal crushing, Pulverized fuel handling system, Ball mill, Pulverized fuel and their advantages, Multi retort stoker, Pulverized fuel burner, Hydraulic and pneumatic ash handling, Electrostatic precipitator.
2.5 Boiler Feed water treatment
2.6 Environmental aspects of steam power plant - water pollution, air pollution, emission standard and

GROUP – B

Module 3 Nuclear power plant

3.1 Fusion and fission reaction, general criteria for selection of site.
3.2 Elements of nuclear power station, layout, types of nuclear reactors.
3.3 Nuclear fuels, coolant & moderators.
3.4 Working of PWR, BWR, CANDU, BREEDER type reactor.
3.5 Safety precautions and waste disposals.

Module 4 Gas turbine power plant

4.1 General Layout, selection of site, Gas turbine power plants in India.
4.2 components of gas turbine plants, gas turbine Fuels.

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4.3 Comparison of Gas turbine plant with diesel and Steam power plant.
4.4 Environmental impact of gas turbine power plant. Waste Heat recovery

GROUP – C

Module 5

5.1 Sources of waste heat
5.2 Heat recovery forms & methods – Sensible and latent Heat recovery.
5.3 Use of waste heat- Agricultural, green house, Animal shelter, Aqua cultural uses, process heating.
5.4 waste Heat recovery boilers

Module 6 Non conventional power generation plants

6.1 Geothermal power plant- types, economical justification
6.2 Tidal power plant- factors affecting suitability of site, working of different tidal power plants, advantages and disadvantages
6.3 Wind power plant- different types, advantages and Disadvantages.
6.4 Solar power plant
6.5 Magneto Hydro dynamics power plant
6.6 Small hydro power plant
6.7 Introduction to Plasma technology in Power Generation.

Module 7 Economics and operational aspects

7.1 Prediction of load, selection of types of generation, number of generating units.
7.2 Load duration curves, cost analysis, elements, controlling the cost of power plant (simple numerical)
7.3 Major electrical equipments in power station- generator, step-up transformer, switch gear, electrical motors

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TOOL ENGINEERING (ELECTIVE – I)

TIUDME

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

Module 1 Metal Cutting

1.1 Mechanics of Metal cutting: requirements of tools, cutting forces – types of chips, chip thickness ratio,
shear angle – simple numerical only,
types of metal cutting process – orthogonal, oblique and form cutting.
Cutting fluids – types, characteristics and applications. Tool wears, Types of wear,
Tool life - Tool life equations.
Machinability – definition, factors affecting machinability, machinability index.
1.2 Tool materials: Types, characteristics, applications. Heat treatment of tool steels, Specification of carbide tips, Types of ceramic coatings.
1.3 Cutting Tool Geometry: Single point cutting tool, drills, reamers, milling cutters.

Module 2 Press Tools

2.1 **Presses:** Types, Specification.
2.2 **Types of dies and construction:** Simple Die, Compound Die, Progressive Die, Combination Die.
Punch & die mountings, pilots, strippers, misfeed detectors, Pressure Pads, Knock outs, stock guide, Feed-Stop, guide bush, guide pins.
2.3 **Die Design Fundamentals:** Die Operations- blanking, piercing, shearing, cropping, notching, lancing, coining, embossing, stamping, curling, drawing, bending, forming. Die set, Die shoe, Die area, Calculation of clearances on die and punch for blanking and piercing dies, Strip layout, Calculation of material utilization factor.
2.4 **Forming Dies:** Bending: methods, Bending Dies, bend allowance, spring back, spanking, bending pressure, pressure pads, development of blank length. Drawing: operations, Metal flow during drawing.
Calculation of drawing blank size, variables affecting metal flow during drawing, single action and double action dies, combination dies.

Module 3 Fundamentals of Other Tools

Constructional features of - Pressure Die casting dies, metal extrusion dies, injection molding dies, forging dies, plastic extrusion dies.