GOVERNMENT OF ASSAM

STATE COUNCIL FOR TECHNICAL EDUCATION, ASSAM

Director of Technical Education, Assam.

DRAFT SYLLABUS OF 4th SEMESTER

Mechanical Engineering

COURSE STRUCTURE NEP – 2020 (FOURTH SEMESTER)												
SL. No.	Course Code	Course Title	Semester	Hours/ Week			Total Credit	Theory		Practical		Total Marks (Theory/ Practical)
				L	T	P		Internal Marks	ESE Marks	Internal Marks	External Marks	
PROGRAM CORE SUBJECTS (All theory and laboratory subjects are compulsory)												
1	MEPC - 401	Thermal Engineering – I	IV	3	0	0	3	40	60			100
2	MEPC - 402	Theory of Machines & Mechanisms	IV	3	0	0	3	40	60			100
3	MEPC - 403	Machine Drawing	IV	0	0	4	2			60	40	100
4	MEPC - 404	Thermal Engineering – I Laboratory	IV	0	0	2	1			60	40	100
5	MEPC - 405	Theory of Machines & Mechanisms Laboratory	IV	0	0	2	1			60	40	100
PROGRAM ELECTIVE – I SUBJECTS (To choose any one subject along with its laboratory subject)												
1	MEPE - 401	*Automobile Engineering – I	IV	3	0	0	3	40	60			100
2	MEPE - 402	Internal Combustion Engines	IV	3	0	0	3	40	60			100
3	MEPE - 403	Welding Science & Technology	IV	3	0	0	3	40	60			100
4	MEPE - 404	*Automobile Engineering – I Laboratory	IV	0	0	2	1			60	40	100
5	MEPE - 405	Internal Combustion Engines Laboratory	IV	0	0	2	1			60	40	100
6	MEPE - 406	Welding Science & Technology Laboratory	IV	0	0	2	1			60	40	100
OPEN ELECTIVE (To choose any one subject along with its laboratory subject if applicable)												
1	MEOE - 401	Universal Human Values – II	IV	2	0	0	2	40	60			100
2	MEOE - 402	Advanced Engineering Mathematics – II	IV	2	0	0	2	40	60			100
3	MEOE - 403	Internet of Things (TTL)	IV	1	0	2	2	16	24	36	24	100
4	MEOE - 404	Innovation Design Thinking & Prototyping (TTL)	IV	1	0	2	2	16	24	36	24	100
5	MEOE - 405	TQM Applicability in Industry (Infosys Springboard)	IV	2	0	0	2	40	60			100
PROJECT (Minor Project to be completed and submitted in the current semester)												
1	MEPR - 401	Minor Project	IV	0	0	4	2			60	40	100
STUDENT INTERNSHIP (Mandatory one month industrial training to be completed after 3rd semester during end semester vacation)												
1	MESI - 401	Student Internship-I	III/IV	0	0	4	2			60	40	100
			TOTAL CREDITS				**20**			**TOTAL MARKS**		**1000**

NOTE: Student taking *Automobile Engineering – I as Program Elective - I subject will mandatorily take Automobile Engineering – II as Program Elective – II subject in higher semester.

Course Code	**MEPC – 401**				
Category	Program Core Course				
Course Title	**Thermal Engineering-I**				
Scheme and Credits	L	T	P	**Credits, C**	**Semester – IV**
	3	0	0	**3**	
Pre-requisites (if any)	Basic Thermodynamics, Fluid Mechanics, Basics of Physics, Math				

Learning Objectives:

Students will be able to:

LO1	Analyze steam power cycles.
LO2	Identify different methods of improving Rankine Cycle performance (Reheat, Regeneration, Binary Vapour Cycle)
LO3	Explain different modes of heat transfer and explore application of fundamental laws such as Fourier's Law and Newton's law of cooling.
LO4	Describe different types of boilers, mountings, accessories and compare fire-tube and water tube boilers and find boiler performance.
LO5	Explain working principles and velocity diagrams of impulse and reaction turbines
LO6	Classify and explain different types of steam condensers, cooling towers and vacuum measurement methods.
LO7	Describe the importance of non-conventional energy and explain basic components of a nuclear power plant

Course Outcomes:

On successful completion of the course students will be able to:

CO1	Analyze steam power cycles and solve numerical problems.
CO2	Illustrate different modes of heat transfer in solving problems and explain heat exchangers with its analysis.
CO3	Identify the components of steam generator or boiler and measure boiler performance and draught.
CO4	Identify different types of nozzles and solve problems on steam turbine using velocity diagram.
CO5	Explain the working principle of steam condensers, cooling tower along with Nuclear Power Plant.

Detailed Syllabus:

Units	Detailed Contents	Contact Hour
UNIT-I	**Introduction to Steam Power Cycle and its analysis:** Basic Components of a steam Power Plant; Performance of Steam Power Cycles – Ideal Cycle Efficiency, Efficiency Ratio, Work Ratio, Isentropic Efficiency, Overall Efficiency, Steam Rate (Specific Steam Consumption), Heat Rate; Carnot Cycle (Steam Operated) – Principal Components and Operation, Limitation of Carnot Cycle; Rankine Cycle – Principal Components and Operation, Analysis of Rankine Cycle; Difference Between Rankine and Carnot Cycle; Effect of Operating Variables on Rankine Cycle; Losses in Actual Steam Power Cycle; Modified Rankine Cycle – Efficiency of modified Rankine Cycle; Reheat Cycle, Reheat Factor; Regenerative cycle – Principle of Regeneration and operation, Regeneration with Open and Closed Feed Water Heater, Advantages and Disadvantages of Regenerative Cycle; Binary Vapour Cycle; Simple Numerical Problems.	06 Hrs
UNIT-II	**Basics of Heat Transfer:** Introduction to heat transfer; Modes of Heat Transfer; Steady and Unsteady Heat Transfer; Heat Transfer by Conduction – Fourier's Law of Heat Conduction; Thermal Conductivity; Thermal Diffusivity; Thermal Resistance, Thermal Conductance, Overall Heat Transfer Co-efficient, Heat Conduction through Plane and Composite Wall; Convection Heat Transfer – Principle of Heat Convection, Types of Heat Convection, Newton's Law of Cooling; Radiation Heat Transfer – Concept of Black Body radiation, Stefan – Boltzmann Law, Max Planck's Theory, Weins Displacement Law, Concept of Gray Body Radiation, Kirchhoff's Law, Emissivity, Absorptivity, Reflectivity, Transmissivity; Heat Exchanger - Introduction, Classification of Heat Exchanger; Basic idea on Parallel Flow, Counter Flow, Cross Flow, Shell and Tube Heat Exchanger; Heat Exchanger analysis – Log Mean Temperature Difference (LMTD) for Parallel Flow and Counter Flow Heat Exchanger, Effectiveness (NTU), Overall Heat Transfer Coe-efficient; Simple Numerical Problem.	10 Hrs
UNIT-III	**Steam Generators:** Introduction; Classification of Boilers; Function of Boilers; Low Pressure Boilers –Working of Cochran and Babcock & Wilcox; boiler; High pressure boilers – Working of La-Mont and Benson Boiler; Comparison of Water Tube and Fire Tube Boilers; Comparison of High-Pressure and Low-Pressure Boilers; Boiler Mountings – Pressure Gauge, Water Level Indicator, Fusible Plug, Blow Off Cock, Feed Check Valve, Steam Stop Valve, Safety Valve; Boiler accessories - Feed Pump, Economizer,	08 Hrs

	Superheater and Air Preheater; Functions of Mountings and Accessories; Draught – Definition and Classification of Draught, Function of Chimney, Chimney Height and Diameter, Condition for Maximum Discharge, Efficiency of Chimney, Draught Losses, Artificial Draught and its Types, Comparison between Forced and Induced Draught; Performance of Steam Generators – Evaporative Capacity, Equivalent Evaporation, Factor of Evaporation, Boiler Efficiency, Thermal Efficiency, Economizer Efficiency, Overall Efficiency, Boiler Power; Heat Balance Sheet; Heat Loss in Boiler Plant; Simple Numerical Problems. .	
UNIT-IV	**Steam Nozzles and Steam Turbines:** Introduction to Steam Nozzles; Functions of Steam Nozzle; Types of Nozzles; Flow of Steam Through Nozzle; Velocity of Steam; Discharge Through Nozzle; Condition for Maximum Discharge; Friction in a Nozzle; Nozzle efficiency; Principle of Steam Injector; Steam Turbine – Introduction, Classification, Advantages of Steam Turbine, Principle of Impulse Turbine, Principle of Reaction Turbine, Difference between Impulse Turbine and Reaction Turbine, Velocity Diagram of Impulse Turbine and Reaction Turbine, Combined Velocity Diagram, Method of Reducing Wheel or Rotor Speed – Pressure Compounding, Velocity Compounding, Pressure and Velocity Compounding; Analysis of Velocity Vector Diagram – Force on Blade, Work Done, Axial Thrust, Blade Efficiency, Stage Efficiency, Overall Efficiency; Working principle with line diagram of a simple De-Laval turbine ; Working principle with line diagram of a Parson's Reaction turbine Losses in Steam Turbine; Simple Numerical Problem on Nozzle and Single Stage Impulse Turbines (without blade friction) and Reaction Turbines.	11 Hrs
UNIT-V	**Steam Condensers and Cooling Tower:** Steam Condenser – Definition, Functions, Elements of a Condensing Plant, Types of Condenser; Jet Condenser – Types, Advantages and Disadvantages; Surface Condenser – Types, Advantages and Disadvantages; Difference between Jet and Surface Condenser; Estimation of Cooling Water; Condenser Efficiency; Analysis of Condenser Operation – Vacuum Creation, Dalton's Law of Partial Pressure, Vacuum Measurement, Vacuum Efficiency; Sources of Air and Effect of Air Leakage on Condenser; Cooling Tower (CT) – Classification, Natural Draft CT, Mechanical Draft CT, Difference between Natural Draft CT and Mechanical Draft CT.	5 Hrs
UNIT-VI	**Nuclear Power Plants:** Importance of Non – Conventional Energy and their availability; Classification of Nuclear Reactors; Nuclear Reactors and Essential Components; Heat Transfer and Fluid Flow in Nuclear Reactors; Advantages and Disadvantages of Nuclear Power Plant over Thermal Plant; Nuclear Waste Disposal.	5 Hrs

Total Contact Hours	45 Hrs

Table of Specification for Thermal Engineering – I																
Sl No	Contact Hours (48)	Units	Objective			Short Answer Type				Long Answers Type						Total Marks
			R	U	AP	R	U	AP	AN	R	U	AP	AN	E	C	
1	06	Unit I	1	2	1	3	3	3	0	6	6	6	6	0	0	**10**
2	10	Unit II	2	1	1	3	3	3	0	0	6	6	0	0	0	**11**
3	08	Unit III	2	1	1	3	3	3	0	0	6	6	6	0	0	**15**
4	11	Unit IV	1	2	2	3	3	3	0	6	6	6	6	0	0	**12**
5	05	Unit V	2	1	2	3	3	3	0	0	6	6	0	0	0	**06**
6	05	Unit VI	2	2	0	3	3	6	0	6	0	0	0	0	0	**06**
Total Marks			**5**	**5**	**5**	**3**	**6**	**6**	**0**	**6**	**6**	**12**	**6**	**0**	**0**	**60**

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Annexure-I (Thermal Engineering – I)										
Sl No.	Units	Time Allotted (Hrs)	Percentage Weightage	R	U	AP	AN	E	C	Total Marks
1	Unit I	06	16.66	10	11	10	6	0	0	**10**
2	Unit II	10	18.33	5	10	10	0	0	0	**11**
3	Unit III	08	25.00	5	10	10	6	0	0	**15**
4	Unit IV	11	20.00	10	11	11	6	0	0	**12**
5	Unit V	05	10.00	5	10	11	0	0	0	**06**
6	Unit VI	05	10.00	11	5	6	0	0	0	**06**
Total		**45**	**100**	**14**	**17**	**23**	**6**	**0**	**0**	**60**

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Reference Book List:

Sl No.	Book Name	Author Name	Publishing House,Volume, ISBN
1	Thermal Engineering	Mahesh M Rathore	Tata McGraw Hill Education Pvt. Ltd., New Delhi
2	Thermal Engineering	R.N.Bahl	Distributor WILEY, Copyright I.K.International Pvt. Ltd., New Delhi
3	Thermal Engineering	R.K.Purohit	Scientific Publishers (India),Jodhpur
4	A Text Book of Thermal Engineering	R.S.Khurmi and J.K.Gupta	S.Chand & Company Ltd., New Delhi
5	Thermal Engineering	S.Semyonov and R.Fesenko	Peace Publisher, Moscow
6	Thermal Engineering	R.K.Rajput	Laxmi Publication Pvt. Ltd., New Delhi

Course Code	**MEPC – 402**				
Category	Program Core Course				
Course Title	**Theory of Machines & Mechanisms**				
Scheme and Credits	**L**	**T**	**P**	**Credits, C**	**Semester – IV**
	3	0	0	**3**	
Pre-requisites (if any)	Mathematics, Physics, Engg., Mechanics, Strength of Materials.				

Learning Objectives:

Students will be able to:

LO1	Demonstrate different types simple mechanism.
LO2	Interpret different kinematic inversion in kinematic chain and calculate velocity of a link.
LO3	Explain different types of cams and follower.
LO4	Solve simple problems on performance of a governor.
LO5	Illustrate belt drive and gear drive in solving power transmission problems.
LO6	Apply balancing methods in unbalanced rotating mass.
LO7	Demonstrate natural frequency of single degree of freedom vibration problems.
LO8	Illustrate friction, torque and power in different bearings to solve problems.
LO9	Apply gyroscopic effect on aeroplanes and naval ships.

Course Outcomes:

On successful completion of the course students will be able to:

CO1	Identify kinematic inversion in different mechanisms and determine the velocity of a link.
CO2	Explain cams and interpret the performances of different types of governors.
CO3	Apply the laws of belting and gearing to solve problems related to power transmission.
CO4	Demonstrate vibrations and principles of balancing to solve engineering problems.
CO5	Identify friction, torque and power in different types of bearings and apply the gyroscopic effect on aeroplanes and naval ships.

Detailed Syllabus:

Units	Detailed Contents	Contact Hour
UNIT-I	**Introduction to Simple Mechanism and Kinematics:** Concept of Mechanism, Machine, Structure and Link; Types of constrained motion; Kinematic Pair and its classification; Kinematic Chain and its types; Kinematic Inversion; Inversion in different chain :Four Bar Chain – Crank and Lever Mechanism, Double Crank Mechanism, Watt Mechanism; Single Slider Crank Chain – Pendulum Pump or Bull Engine, Oscillating Cylinder Engine, Rotary I.C Engine or Gnome Engine, Crank and Slotted Lever Quick Return Mechanism, Whitworth Quick Return Motion Mechanism; Double Slider Crank Chain – Elliptical Trammel, Scotch Yoke Mechanism, Oldham Coupling; Types of joints and links in a chain; Degrees of freedom or Mobility; Gruebler's Equation and Exceptions; Grashof's Law and condition of inequality; Velocity of a Link: Methods to find velocity in a link; Instantaneous Centre Method – Properties, Number and Types of Instantaneous Centre, Locating Instantaneous Centres, Kennedy's Theorem, Angular Velocity of a Link; Simple numerical problems on simple mechanism and velocity of link. Brief review on: Plane motion, Angular displacement, Angular velocity	09 Hrs
UNIT-II	**Cam & Follower and Governor:** **Cam:** Function of cam; Classification of cam; Types of follower; Radial Cam Nomenclature; Types of follower motion; Principle of kinematic inversion for cam profile; Parameters defining cam size; Introduction to displacement, velocity and acceleration diagram for cam at different motion of follower; **Governors:** Function of Governor; Types of Governors; Terminology of governor; Performance of Governor – Sensitiveness, Stability, Isochronism, Hunting, Governor effort, Power; Controlling force; Centrifugal Governor; Watt Governor; Porter Governor; Numerical Problems;	08 Hrs
UNIT-III	**Transmission of Power:** **Flat Belt drive –** Types of flat belt drive, Velocity ratio, Velocity ratio of compound belt drive, Slip, Creep, Law of belting, Length of open and cross belt drive, Angle of arc of contact, Initial belt tension, Friction tensions in open and cross belt drive, Centrifugal tensions in belt drive, Effective tension on tight and slack side, Power transmission, Condition for maximum Power; **Gear –** Definition and function; Condition for no slip; Classification; Terminology used in Gear; Law of Gearing without derivation; Velocity of sliding basic knowledge without derivation; Types of teeth profile; Length of path of contact, arc of contact and contact ratio – Basic knowledge with formula; Idea on interference of gear and minimum number of teeth; **Gear Train –** Definition, Types of gear train, Velocity ratio – Simple gear train, compound gear train and epicyclic gear train; Simple problems.	13 Hrs

UNIT-IV	**Balancing of Rotating Mass and Mechanical Vibrations:** **Balancing:** Definition; Causes of unbalance; Static and dynamic balancing; Balancing a single rotating mass in the same and different plane; Balancing of several mass in the same plane; Simple problems; **Mechanical Vibrations:** Definitions – Time period, Cycle, Frequency, Resonance etc; Types of Vibratory motion; Basic elements of vibrating systems; Degrees of freedom; Simple harmonic motion; Types of free vibrations; Derivation of natural frequency for free vibration (single degree of freedom systems) – longitudinal vibration (spring), Transverse vibration (one end fixed), Torsional vibration (single rotor); Equivalent stiffness of spring; Whirling speed of shaft; Simple problems.	08 Hrs
UNIT-V	**Bearings and Gyroscopic Couple:** **Bearings:** Friction in Journal bearing – Greasy friction, Friction circle, Expression for Torque and Power of shaft, Simple problems; Pivot and Collar bearings – Types of Pivot and Collar bearings, Expression for Torque and Power under uniform pressure and uniform wear, Simple problems. **Gyroscopic Couple:** Introduction; Precessional angular motion; Gyroscopic Couple; Gyroscopic effect on aeroplane; Naval ship – Gyroscopic effect during steering, pitching and rolling; Simple problems.	07 Hrs
Total Contact Hours		**45 Hrs**

Table of Specification for Theory of Machines & Mechanisms															
Sl No	**Contact Hours (48)**	**Units**	**Objective**			**Short Answer Type**				**Long Answers Type**					**Total Marks**
			R	**U**	**AP**	**R**	**U**	**AP**	**AN**	**R**	**U**	**AP**	**AN**	**E**	**C**	
1	09	Unit I	1	2	1	2	2	3	0	0	0	6	0	0	0	**11**
2	08	Unit II	2	1	2	2	2	3	0	0	0	6	0	0	0	**11**
3	13	Unit III	2	1	2	2	2	3	0	0	0	6	0	0	0	**11**
4	08	Unit IV	1	2	2	2	2	3	0	0	0	8	0	0	0	**15**
5	07	Unit V	2	1	2	2	2	3	0	0	0	6	0	0	0	**12**
Total Marks			**5**	**5**	**5**	**4**	**4**	**6**	**0**	**0**	**0**	**31**	**0**	**0**	**0**	**60**

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Annexure-I (Theory of Machines & Mechanisms)										
Sl No.	**Units**	**Time Allotted (Hrs)**	**Percentage Weightage**	**R**	**U**	**AP**	**AN**	**E**	**C**	**Total Marks**
1	Unit I	08	18.33	3	4	10	0	0	0	**11**
2	Unit II	09	18.33	4	3	11	0	0	0	**11**
3	Unit III	10	18.33	4	3	11	0	0	0	**11**
4	Unit IV	10	25.00	3	4	13	0	0	0	**15**
5	Unit V	08	20.00	4	3	11	0	0	0	**12**
Total		**45**	**100**	**09**	**09**	**42**	**0**	**0**	**0**	**60**

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Reference Book List:

Sl No.	Book Name	Author Name	Publishing House,Volume, ISBN
1	A Text Book of Theory of Machine	R.K.Bansal & J.S.Brar	Laxmi Publications (P) Ltd., New Delhi
2	Theory of Mechanisms and Machines	A.Ghosh and A.K.Mallik	EWP Pvt. Ltd., New Delhi
3	Theory of Machines	S.S.Rattan	Tata McGraw Hill Education Pvt. Ltd., New Delhi
4	Fundamentals of Kinematics and Dynamics of Machines and Mechanisms	Oleg Vinogradov	CRC Press LLC, Washington DC
5	Theory of Machines	Thomas Bevan	Longmans Green and Co. INC, New York
6	Theory of Machines Kinematics and Dynamics	Sadhu Singh	Pearson, New Delhi
7	Theory of Machines	R.S.Khurmi & J.K.Gupta	S.Chand & Co., New Delhi
8	Theory of Machines and Mechanisms	Prof. P.L.Ballaney	Khanna Publisher, New Delhi

Course Code	**MEPC – 403**				
Category	Program Core Course				
Course Title	**Machine Drawing**				
Scheme and Credits	**L**	**T**	**P**	**Credits, C**	**Semester – IV**
	0	0	4	**2**	
Pre-requisites (if any)	Mathematics, Engineering Graphics, CAD software skills.				

Learning Objectives:

Students will be able to:

LO1	Identify orthographic views and true shape of a solid like prisms, pyramids, cylinders, cones and spheres and illustrate intersection of surface.
LO2	Construct orthographic views of keys, cotter Joints, pin Joints and pipe joint.
LO3	Represent welded joints in engineering drawing.
LO4	Identify orthographic views of shaft couplings, bearings and brackets.
LO5	Construct orthographic views of engine parts and pulleys.
LO6	Develop assembly drawing of mechanical components from the details of given part list.

Course Outcomes:

On successful completion of the course students will be able to:

CO1	Construct sectional front view, top view, side view and true shape of solid like prisms, pyramids, cylinders, cones and spheres and illustration of intersection of surface.
CO2	Identify orthographic views (Front view/Top view /Side view) of keys, cotter Joints, pin Joints, pipe joint and show the representation of welded joints.
CO3	Construct orthographic views (Front view/ Top view /Side view) of shaft couplings, bearings, and brackets.
CO4	Illustrate orthographic views of engine parts and pulleys.
CO5	Utilize details of the part list and assemble different parts of mechanical components.

Detailed Syllabus:

Units	Detailed Contents	Contact Hour
UNIT-I	**Introduction:** **Section of solids:** Prisms, pyramids, cylinders, cones, spheres; Sectional front view, side view and true shape of solid for section plane at different orientation; **Intersection of Surface:** Line Method, Cutting Plane Method, Intersection of two prisms, cylinder and cylinder, cylinder and prism. **Brief review on:** Dimensioning; Ideas of different lines; Projection of solids; 1st angle Projection; 3rd angle projection; Types of sectional views – Full section, Half section; Sectioning convention; Section lines etc.	06 Hrs
UNIT-II	**Keys, Cotter Joints, Pin Joints, Pipe and Welded Joints:** Orthographic views with Full section / half section of: **Keys** – Taper keys, Feather key, Woodruff key; Gib head; Spline shaft; **Cotter Joint** – Cotter joint with Sleeve, Cotter joint with Socket and spigot ends, Cotter joint with Gib or Strap joint; **Pin Joints** – Knuckle joint; **Pipe Joints** – Cast Iron Flange Joint, Socket and Spigot Joint, Union Joint; CI pipe fittings; **Welded Joints** – Types of welded joints, Types of welds, Representation of welded joints.	14 Hrs
UNIT-III	**Shaft Couplings, Bearings, and Brackets:** Orthographic views with Full section / half section of: **Shaft Couplings:** Rigid couplings – Muff couplings, Half-lap couplings, Flanged coupling, Protected type Flange couplings, Solid Flange couplings; Flexible couplings; Non-aligned couplings – Universal couplings, Oldham couplings; **Shaft Bearings:** Kinds of sliding contact bearings, Journal bearings – Solid journal bearing, Bushed journal bearing, Pedestal bearing, Pivot bearings – Foot step bearing; Thrust bearings – Collar thrust bearings; **Brackets:** Wall bracket, U-type hanger.	14 Hrs
UNIT-IV	**Engine parts and Pulleys:** Orthographic drawing in Full section / half section view of Steam Engine piston and rings – Steam and S.I Engine; Stuffing box; Cross head; Simple eccentric; Connecting rod – Petrol and Marine engine; **Pulleys:** Fast and loose pulleys, Stepped pulleys, V-belt pulleys.	12 Hrs
UNIT-V	**Assembly Drawings:** Types of assembly drawings; Norms practiced in assembly drawings; Preparations of assembly drawings; Make assembly drawings of engineering components like Knuckle joints, Cotter joints, Pedestal bearings, Couplings, Stuffing Box, Cross head, Eccentric – Any three assembly drawings. Introduction AUTOCAD and use of AUTOCAD or suitable CAD software in generating orthographic views for assembly drawings / part drawings of machine components.	14 Hrs
Total Contact Hours		**60 Hrs**

Table of Specification for Machine Drawing																
Sl No	**Contact Hours (48)**	**Units**	**Objective**			**Short Answer Type**				**Long Answers Type**						**Total Marks**
			R	**U**	**AP**	**R**	**U**	**AP**	**AN**	**R**	**U**	**AP**	**AN**	**E**	**C**	
1	06	Unit I	1	1	1	0	0	4	0	0	0	5	0	0	0	**6**
2	14	Unit II	1	1	1	0	0	4	0	0	0	8	0	0	0	**10**
3	14	Unit III	1	1	1	0	0	4	0	0	0	8	0	0	0	**8**
4	12	Unit IV	1	1	1	0	0	4	0	0	0	8	0	0	0	**8**
5	14	Unit V	1	1	1	0	0	4	0	0	0	8	0	0	0	**8**
Total Marks			**1**	**1**	**2**	**0**	**0**	**4**	**0**	**0**	**0**	**32**	**0**	**0**	**0**	**40**

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Annexure-I (Machine Drawing)										
Sl No.	**Units**	**Time Allotted (Hrs)**	**Percentage Weightage**	**R**	**U**	**AP**	**AN**	**E**	**C**	**Total Marks**
1	Unit I	06	15.00	1	1	10	0	0	0	**06**
2	Unit II	14	25.00	1	1	13	0	0	0	**10**
3	Unit III	14	20.00	1	1	13	0	0	0	**08**
4	Unit IV	12	20.00	1	1	13	0	0	0	**08**
5	Unit V	14	20.00	1	1	13	0	0	0	**08**
Total		**60**	**100**	**01**	**01**	**38**	**0**	**0**	**0**	**40**

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Reference Book List:

Sl No.	**Book Name**	**Author Name**	**Publishing House,Volume, ISBN**
1	Machine Drawing	Ajeet Singh	Tata McGraw Hill Companies, New Delhi
2	Machine Drawing	N.D.Bhatt and V.M.Panchal	Charotar Publishing House, India
3	Machine Drawing	K.L.Narayana, P.Kannaiah and K.Vankata Reddy	New Age International (P) Limited, New Delhi

Course Code	**MEPC – 404**				
Category	Program Core Course				
Course Title	**Thermal Engineering – I Laboratory**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-IV**
	0	0	2	**1**	
Pre-requisites (if any)	Thermal Engineering-I, Basics of Mechanical Engineering.				

Learning Objectives:

Students will be able to:

LO1	Demonstrate Rankine Cycle and layout of a steam power plant.
LO2	Identify heat transfer coefficients in experimenting with heat transfer through conduction, free convection and composite wall.
LO3	Interpret LMTD and effectiveness of parallel flow and counter flow heat exchanger.
LO4	Demonstrate low-pressure and high-pressure boilers with their mountings and accessories and prepare heat balance sheet.
LO5	Demonstrate working of impulse and reaction turbine and find power out-put and efficiency of a steam turbine.
LO6	Demonstrate jet condenser and cooling tower and its efficiency.
LO7	Interpret dryness fraction of steam and analyse flue gas from chimney.

Course Outcomes:

On successful completion of the course students will be able to:

CO1	Apply fundamental engineering principles and concepts to set up the experiment for investigation.
CO2	Select proper procedure with necessary tools and equipment for conducting the experiment.
CO3	Utilize correct working procedure for conducting experiment by following standard laboratory safety practices.
CO4	Demonstrate proficiency in collecting data/ representing data/ report writing/ viva-voce/ presentation along with handling laboratory equipment safely and correctly.
CO5	Examine the result of experimentation through the appropriate equations / formulae/ tools and techniques and publish/document.

List of Practices:

Sl. No.	Topics For Practices (Any eight experiments)	Contact Hours
1	To study Rankine Cycle and different components of a steam power plant.	4
2	Determination of Thermal Conductivity of a metal rod.	4
3	Determination of Heat Transfer Coefficient in a free Convection on a vertical tube.	4
4	Determination of Overall Heat Transfer Coefficient of a Composite wall.	4
5	Determination of LMDT and Effectiveness in a Parallel Flow and Counter Flow Heat Exchangers.	4
6	To study low pressure boilers and their accessories and mountings.	4
7	To study high pressure boilers and their accessories and mountings.	4
8	To prepare heat balance sheet for given boiler.	4
9	To study the working of impulse and reaction steam turbines	4
10	To find power out-put & efficiency of a steam turbine.	4
11	To study jet condenser.	4
12	To find the condenser efficiencies.	4
13	To study cooling tower and find its efficiency.	4
14	To find dryness fraction of steam by separating and throttling calorimeter.	4
15	Analyse flue gas using Orsat's apparatus	4
Total Hours		**30**

Reference Book Lists:

Sl No.	Book Name	Author Name	Publishing House, Volume, ISBN
1	Thermal Engineering	R.K.Rajput	Laxmi Publication Pvt. Ltd., New Delhi
2	Thermal Engineering	Mahesh M Rathore	Tata McGraw Hill Education Pvt. Ltd., New Delhi
3	Thermal Engineering	R.N.Bahl	Distributor WILEY, Copyright I.K.International Pvt. Ltd., New Delhi
4	A Text Book of Thermal Engineering	R.S.Khurmi and J.K.Gupta	S.Chand & Company Ltd., New Delhi

Course Code	**MEPC – 405**				
Category	Program Core Course				
Course Title	**Theory of Machines & Mechanisms Laboratory**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-IV**
	0	0	2	**1**	
Pre-requisites (if any)	Mathematics, Physics, Engg. Mechanics, Strength of Materials.				

Learning Objectives:

Students will be able to:

LO1	Interpret simple mechanism and demonstrate different kinematic inversion in kinematic chain.
LO2	Demonstrate different types of cams and follower arrangement.
LO3	Illustrate different types of centrifugal and inertia governor and find its performance.
LO4	Illustrate gear and gear train in power transmission.
LO5	Demonstrate static and dynamic balancing of rotating mass and find whirling speed of a shaft.
LO6	Illustrate undamped free longitudinal and transverse vibrations.
LO7	Demonstrate gyroscopic effect on a motorised Gyroscope.

Course Outcomes:

On successful completion of the course students will be able to:

CO1	Apply fundamental engineering principles and concepts to set up the experiment for investigation.
CO2	Select proper procedure with necessary tools and equipment for conducting the experiment.
CO3	Utilize correct working procedure for conducting experiment by following standard laboratory safety practices.
CO4	Demonstrate proficiency in collecting data/ representing data/ report writing/ viva-voce/ presentation along with handling laboratory equipment safely and correctly.
CO5	Examine the result of experimentation through the appropriate equations / formulae/ tools and techniques and publish/document.

List of Practices:

Sl. No.	Topics For Practices (Any eight experiments)	Contact Hours
1	To study various types of kinematic link, pairs, chains and mechanism on Kinematic Pair Board.	4
2	To study inversions of 4 Bar Mechanisms, Single & double slider crank mechanisms.	4
3	To draw displacement diagram, velocity diagram & acceleration diagram of cam follower.	4
4	To study various types of cam and follower arrangements.	4
5	To study different types of centrifugal and inertia governors and demonstrate anyone.	4
6	To study various types of gears and discuss various teeth profile.	4
7	To study various types of gear train – simple, compound, reverted and epicyclic and determine velocity ratio.	4
8	To determine critical speed or whirling speed of a rotating shaft and to verify the value theoretically.	4
9	To perform experiment for static / dynamic balancing of rotating mass.	4
10	To perform experiment on undamped free longitudinal and transverse vibration on Universal Vibration Apparatus.	4
11	To find experimentally the Gyroscopic couple on Motorized Gyroscope Apparatus and compare with applied couple.	4
Total Hours		**30**

Reference Book Lists:

Sl No.	Book Name	Author Name	Publishing House, Volume, ISBN
1	A Text Book of Theory of Machine	R.K.Bansal & J.S.Brar	Laxmi Publications (P) Ltd., New Delhi
2	Theory of Machines	R.S.Khurmi & J.K.Gupta	S.Chand & Co., New Delhi
3	Theory of Machines	S.S.Rattan	Tata McGraw Hill Education Pvt. Ltd., New Delhi
4	Theory of Machines Kinematics and Dynamics	Sadhu Singh	Pearson, New Delhi
5	Theory of Machines	Thomas Bevan	Longmans Green and Co. INC, New York

Course Code	**MEPE – 401**				
Category	Program Elective Course				
Course Title	**Automobile Engineering - I**				
Scheme and Credits	**L**	**T**	**P**	**Credits, C**	**Semester – IV**
	3	0	0	**3**	
Pre-requisites (if any)	Physics, Chemistry, Math, Engg., Mechanics, Thermodynamics, Internal Combustion Engines.				

Learning Objectives:

Students will be able to:

LO1	Classify automobile and explain function of major components.
LO2	Explain basics of hybrid car and classify chassis and frame.
LO3	Utilize principle of air standard cycle to find engine performance.
LO4	Identify constructional details of engine, valve operation, knocking, firing order and balance of engine with engine problem and remedies.
LO5	Identify fuel supply system of petrol and diesel engine and methods of fuel injection.
LO6	Explain supercharging and turbo charging of petrol and diesel engine along with exhaust system.
LO7	Illustrate different engine cooling methods of petrol and diesel engine.
LO8	Explain lubricants and its properties along with lubricating system of petrol and diesel engine.
LO9	Illustrate DC and A.C generating unit of the engine.
LO10	Explain ignition system and parts assisting ignition.

Course Outcomes:

On successful completion of the course students will be able to:

CO1	Classify automobile and chassis frame enlisting functions of major components along with an introduction to the basics of hybrid car.
CO2	Utilize principle of air standard cycle to find engine performance and identify constructional details of engine, combustion, valve operation, knocking and balance of engine.
CO3	Identify different fuel supply system of S.I and C.I Engines and also illustrate the exhaust system of petrol and diesel engines.
CO4	Illustrate different cooling and lubrication system of engine and chassis frame.
CO5	Interpret construction and working principle of DC and AC generating unit of automobile and also explain different ignition methods and parts assisting ignition.

Detailed Syllabus:

Units	Detailed Contents	Contact Hour
UNIT-I	**Introduction to Automobiles and Hybrid car:** Definition of an Automobile; Classification of an Automobile; Major Components of an Automobile and Function; Resisting Forces in motion of a vehicle; Brief idea of Electric Car; Hybrid Car – Classification of Hybrid System, Working of Hybrid Car, Main Components of Hybrid System; Chassis – Definition and Main Components of Chassis; Layout of Chassis; Classification of Chassis; Frame – Definition, Functions and Types of Frame; Loads on Frame; Function of Different Frame Sections; Sub- Frame; Defects in Frame; Vehicle Dimensions – Wheel Track, Wheel Base; Body – Definition, Requirements and Types.	06 Hrs
UNIT-II	**Automobile Engines:** Basic Engine Terminology; Classification of Automobile Engines; Material used , Constructional Details and Function of Cylinder Block, Cylinder Head, Cylinder Liner (Dry and Wet Type), Crank Case, Crankshaft, Camshaft, Piston, Piston Rings, Piston Pin, Connecting Rod, Gasket, Inlet and Exhaust Manifolds etc.; Valve mechanism, Classification of Engines According to Valve Arrangement, Valve Overlap, Tappet Clearance, Valve Timing Diagram (Theoretical and Actual); Basic Idea of Air Standard Cycle in Automobile; Two-Stroke Petrol and Diesel Engines; Four- Stroke Petrol and Diesel Engines; Advantages and Disadvantages of Petrol and Diesel Engines; Comparison of Two-Stroke and Four-Stroke Engines; Comparison of Petrol and Diesel Engines; Comparison of S.I and C.I Engine; Port Timing Diagram; Indicator Diagram; Stages of Combustion in S.I and C.I Engines; Knocking / Detonation; Octane Ratings; Cetane Number; Types of Combustion Chamber for S.I and C.I Engine; Types of Vibration in Engines; Types of Balancing in Engine; Firing Order and Balance of Various Engines; Preventive Maintenance Schedule of Automobile Engine Parts; Important Engine Troubles and Causes. Simple Problem from any relevant topics from this Unit.	12 Hrs
UNIT-III	**Fuel System and Exhaust of Petrol and Diesel Engine:** Function of Fuel Supply System; Components of Fuel Supply System of Petrol Engine; Fuel Supply Systems – Different Types with Descriptions; Carburetion; Functions of Carburettor; Air-Fuel Ratio; Classification of Carburettor; Simple Carburettor; Different Circuits in Carburettor; Defects in Simple Carburettor; Compensating Device in Carburettor; Solex and Zenith Carburettor; Modern Carburettors; Petrol Injection; Advantages and Disadvantages of Petrol Injection; Injector Location; Types of Petrol Injection; Multipoint Fuel Injection (MPFI); Types of MPFI; Electronic Fuel Injection (EFI); Supercharging; Types of Supercharger; Location of Supercharger; Turbocharger – Functions, Operation and Working; Classification of Diesel Fuel Injection System; Diesel Engine Fuel System Components; Fuel Injectors; Bleeding of Injection System; Function of Governor; Types of Governors and Working Principle; Exhaust Manifold; Exhaust Pipe; Muffler – Functions and Description of Types of Muffler; Scavenging; Types of Scavenging – Uniflow, Back Flow, Cross Flow;	10 Hrs

UNIT-IV	**Engine Cooling, Lubricants and Lubrication System:** Cooling: Objective of Cooling; Effects of Over Cooling; Properties of Efficient Cooling; Cooling Methods – Air Cooling, Water Cooling, Liquid Cooling, Steam Cooling; Air Cooling – Advantage & Disadvantage, Fan Cooling, Fins, Baffle; Water Cooling – Thermosiphon, Pump Circulation System; Parts of Water Cooling System; Function of Different Components of Water Cooling System; Radiator and its Types; Temperature Indicator; Antifreeze Materials; Function and Properties of Antifreeze Materials; Lubrication: Objective of Lubrication; Physical and Chemical Properties of Lubricants; Types of Lubricants; Viscosity Ratings; Flash Point and Fire Point Test; SAE Ratings; Adverse effects of Lubricating Oil on Engine Performance; Crankcase ventilation; Lubricating System – Chassis Lubrication and Engine Lubrication; Engine Lubrication – Engine Parts for Lubrication, System of Engine Lubrication – Petroil, Splash, Pressure, Semi-Pressure, Dry-Sump System; Function of Main Components of Lubricating System – Oil Sump, Oil Pump, Oil Cooler, Oil Filter, Oil Pressure Gauge, Oil Pressure Indicator, Oil Level Indicator; Cooling and Lubrication Troubleshooting and remedies.	09 Hrs
UNIT-V	**Electrical System of Automobile:** Types of Battery; Battery Voltage; Battery Capacity; Battery Ratings; Battery Life and Factors affecting Battery Life; Battery Troubles; Function of a Generator; Construction and Working Principle of DC Generator; Construction and Working Principle of Alternator; Difference Between Alternator and Generator; Objective of A.C and D.C Generator Regulation; Functions of Cranking Motor and Drive Arrangement; Types of Drive Arrangement; Requirements of Ignition System; Types of Ignition System – Battery Ignition System and Magneto Ignition System; Comparison of Battery and Magneto Ignition System; Function of Ignition Coil, Condenser, Contact Breaker, Distributor; Firing Order; Ignition Advance; Automatic Ignition Advance Methods; Spark Plug – Function, Types, Parts, Working, Spark Plug Gap; Ignition Timing.	08 Hrs
Total Contact Hours		**45 Hrs**

Table of Specification for Automobile Engineering – I

Sl No	Contact Hours (45)	Units	Objective			Short Answer Type				Long Answers Type						Total Marks
			R	U	AP	R	U	AP	AN	R	U	AP	AN	E	C	
1	06	Unit I	1	1	0	3	3	0	0	6	6	0	0	0	0	**10**
2	12	Unit II	2	1	3	3	3	3	0	6	6	6	0	0	0	**15**
3	10	Unit III	1	2	2	3	3	3	0	6	6	6	0	0	0	**12**
4	09	Unit IV	1	2	0	3	3	0	0	6	6	0	0	0	0	**12**
5	08	Unit V	2	2	0	3	3	0	0	6	6	0	0	0	0	**11**
Total Marks			**5**	**5**	**5**	**3**	**6**	**6**	**0**	**6**	**12**	**12**	**0**	**0**	**0**	**60**

NB: R: Remember, **U:** Understand, **AP:** Apply, **AN:** Analyze, **E:** Evaluate, **C:** Create

Annexure-I (Automobile Engineering – I)										
Sl No.	**Units**	**Time Allotted (Hrs)**	**Percentage Weightage**	**R**	**U**	**AP**	**AN**	**E**	**C**	**Total Marks**
1	Unit I	06	18.33	09	09	0	0	0	0	**10**
2	Unit II	12	18.33	10	10	09	0	0	0	**15**
3	Unit III	10	18.33	09	11	08	0	0	0	**12**
4	Unit IV	09	25.00	09	11	0	0	0	0	**12**
5	Unit V	08	20.00	10	11	0	0	0	0	**11**
Total		**45**	**100**	**14**	**23**	**23**	**0**	**0**	**0**	**60**

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Reference Book List:

Sl No.	**Book Name**	**Author Name**	**Publishing House,Volume, ISBN**
1	A Text Book of Automobile Engineering	R.K.Rajput	Laxmi Publications (P) Ltd., New Delhi
2	Automobile Engineering	K.K.Jain and R.B. Asthana	Tata McGraw Hill Publishing Co. Ltd., New Delhi
3	Automobile Engineering	S.K.Saxena	University Science Press, New Delhi
4	Automobile Engineering	Prof. R.B.Gupta	Satya Prakashan, New Delhi
5	Automobile Engineering	Kirpal Singh	Standard Publishers Distributors, New Delhi
6	A Text Book on Automobile Engineering	T.R.Banga and Nathu Singh	Khanna Publishers, New Delhi
7	A Text Book of Internal Combustion Engines	Er. R.K.Rajput	Laxmi Publications (P) Ltd., New Delhi

Course Code	**MEPE – 402**				
Category	Program Elective Course				
Course Title	**Internal Combustion Engines**				
Scheme and Credits	**L**	**T**	**P**	**Credits, C**	**Semester – IV**
	3	0	0	**3**	
Pre-requisites (if any)	Theory of Machines, Thermodynamics, Fluid Mechanics, Basics of Physics, Math & Chemistry.				

Learning Objectives:

Students will be able to:

LO1	Apply Air Standard Cycles in Internal Combustion Engines.
LO2	Identify fuel cycles and actual cycles of Internal Combustion Engines.
LO3	Explain different phases of combustion in S.I and C.I Engines.
LO4	Illustrate the factors involved in combustion of S.I and C.I Engine.
LO5	Explain different types of fuels in Internal Combustion Engines.
LO6	Demonstrate carburetion and carburettors in Internal Combustion Engines.
LO7	Interpret ignition in Internal Combustion Engines.
LO8	Demonstrate different fuel injection system in S.I and C.I Engines.
LO9	Identify performance parameters of Internal Combustion Engines.
LO10	Select measures for testing and control of emission in Internal Combustion Engines.

Course Outcomes:

On successful completion of the course students will be able to:

CO1	Identify the basic principle in the operation of Internal Combustion Engines.
CO2	Demonstrate combustion in S.I and C.I Engines.
CO3	Identify different fuels and principle of carburetion in carburettors.
CO4	Interpret ignition and fuel injection system in Internal Combustion Engine.
CO5	Identify performance parameter, testing and select measures for emission and control in Internal Combustion Engine.

Detailed Syllabus:

Units	Detailed Contents	Contact Hour
UNIT-I	**Introduction to Internal Combustion Engine:** Definition of I.C. Engine, Classification of I.C. Engine, Basic Engine Components; I.C. Engine Terminology; Concept of TDC, BDC, IDC and ODC; Basic Engine Cycles – Auto Cycles, Diesel Cycles, Dual Cycles, Basic Idea of S.I. Engine, C.I. Engine; Difference between S.I and C.I. Engine; Two Stroke S.I and C.I. Engine; Four Stroke S.I and C.I. Engine; Difference between Two Stroke and Four Stroke Engine; Basic Idea of Reciprocating and Rotary Engines; Basic Idea of In – line Engine, V – Engine, Opposed Cylinder Engines, Opposed Piston Engine, W – Engine, Radial Engine; Valve and Port Timing diagram; Application of I.C. Engine; Assumption for Fuel-Air Cycles; Importance of Fuel-Air Cycle; Losses in Actual Cycle; Reason for deviation of actual cycle from Fuel-Air Cycle; Comparison of operations and working media for Air Standard Cycle, Fuel-Air Cycle and Actual Cycle. Simple problems. Purpose of Supercharging; Methods of Supercharging; Thermodynamic Cycle with Supercharging; Supercharging of S.I and C.I Engines; Supercharging Limits of S.I and C.I Engine; Types of Superchargers; Turbocharger; Method of Turbocharging; Simple Problem from this unit.	12 Hrs
UNIT-II	**Combustion in S.I and C.I Engines:** Definition of Combustion; Homogenous and Heterogenous Mixture; Combustion in SI Engine: Combustion – Normal Combustion, Abnormal Combustion and Uncontrolled Combustion; Stages of Combustion; Flame Front Propagation; Factors affecting Ignition Lag, Flame Propagation, Normal Combustion in S.I. Engine; Detonation – Definition, Theories of Detonation, ; Effect of Knocking / Detonation; Control of Detonation, Factors affecting Detonation, Performance Number; Uncontrolled Combustion; Combustion Chambers – Types, Basic Requirements; Combustion in C.I. Engine: Stages of Combustion; Physical Delay and Chemical Delay; Factors Affecting Delay Period; Knocking in C.I. Engine; Comparison of Knock in S.I and C.I. Engine.	10 Hrs
UNIT-III	**Fuels, Carburetion and Carburettor:** Classification of Fuels; Types of Solid Fuels, Liquid Fuels and Gaseous Fuels; Characteristics of S.I. & C.I Engine Fuels; Flash Point; Fire Point; Knock Rating of S.I. Engine Fuels – Self Ignition Characteristics, Highest Useful Compression Ratio (H.U.C.R), Octane Number, Cetane Number, Fuel Sensitivity, Antiknock Substances, Antiknock Index, Diesel Index; Advantage of High-Octane Fuel; Combustion Equations of Hydrogen and Carbon; Stoichiometric Air-Fuel Ratio; Orsat's Apparatus; Calorimeters; Carburetion; Factors affecting Carburetion; Air-Fuel Mixture; Air-Fuel Mixture at different Loads and Speeds; Transient Mixture Requirements; Requirements of a Good Carburettor; Simple Carburettor; Function of –	08 Hrs

	Metering System, Idling System, Economiser, Acceleration Pump and Choke; Compensating Devises in Carburettor; Types of Carburettor; Drawbacks of a Modern Carburettor; Methods for Governing of I.C Engine;	
UNIT-IV	**Ignition and Fuel Injection System:** Energy Requirements for Ignition; Requirements of an Ignition System; Types of Ignition Systems; Construction and Working of Battery and Magneto Ignition System; Comparison of Battery and Magneto Ignition System; Firing Order; Dwell Angle; Ignition Timing; Spark Advance Mechanisms; Function of Spark Plug; Factors affecting arc establishment in Spark Plug; Basic Idea of Electronic Ignition System; Requirements of Injection System; Classification of S.I Injection System; Direct Injection; Indirect Injection; Single Point Injection; Multi Point Injection; Mechanical Fuel Injection System; Electronic Fuel Injection System; Advantages and Disadvantages of MPFI System; Comparison of Petrol Injection and Carburetted Fuel Supply System; Classification of C.I Injection System; Common Rail Injection System; Solid Injection; Individual Pump Injection; Fuel Pump and Fuel Injector; Spray Characteristics – Spray formation, Atomization, Penetration, Dispersion.	08 Hrs
UNIT-V	**Testing and Performance and Exhaust Emissions:** Calculation of Performance Parameters – Power, Mechanical Efficiency, Volumetric Efficiency, Specific Fuel Consumption, etc.; Measurements of Brake Power – Prony Brake, Rope Brake; Measurement of Indicated Power – Indicator Diagram, Calculation of Indicated Power, Types of Engine Indicator; Different Methods Measurement of Frictional Power – Morse Test, Motoring Test, etc.; Types of Devices for Fuel and Air Consumption Measurement – Gravimetric Fuel Flow, Volumetric Type, Orifice Method, Viscous Flowmeter, etc.; Performance Characteristic Curves; Basic Knowledge of Heat Balance Sheet; Sources of S.I. Engine Emissions; S.I Engine Emission Control; Constituents of Exhaust Emissions of S.I and C.I Engines; Control of Exhaust Emissions. Simple Problems from this unit.	07 Hrs
Total Contact Hours		**45 Hrs**

Table of Specification for Design of Machine Elements

Sl No	Contact Hours (48)	Units	Objective			Short Answer Type				Long Answers Type						Total Marks
			R	U	AP	R	U	AP	AN	R	U	AP	AN	E	C	
1	12	Unit I	1	2	1	2	2	3	0	0	6	6	0	0	0	**14**
2	10	Unit II	2	1	0	2	3	3	0	0	6	0	0	0	0	**12**
3	08	Unit III	2	1	0	2	3	3	0	0	6	0	0	0	0	**11**
4	08	Unit IV	1	2	0	2	3	3	0	0	6	0	0	0	0	**11**
5	07	Unit V	2	1	2	2	2	3	0	0	6	6	0	0	0	**12**
Total Marks			**5**	**5**	**5**	**3**	**6**	**6**	**0**	**0**	**18**	**12**	**0**	**0**	**0**	**60**

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Annexure-I (Internal Combustion Engine)										
Sl No.	**Units**	**Time Allotted (Hrs)**	**Percentage Weightage**	**R**	**U**	**AP**	**AN**	**E**	**C**	**Total Marks**
1	Unit I	12	18.33	3	10	10	0	0	0	**14**
2	Unit II	10	18.33	4	10	03	0	0	0	**12**
3	Unit III	08	18.33	4	10	03	0	0	0	**11**
4	Unit IV	08	25.00	4	11	03	0	0	0	**11**
5	Unit V	07	20.00	4	09	11	0	0	0	**12**
Total		**45**	**100**	**08**	**29**	**23**	**0**	**0**	**0**	**60**

NB: R: Remember, **U:** Understand, **AP:** Apply, **AN:** Analyze, **E:** Evaluate, **C:** Create

Reference Book List:

Sl No.	**Book Name**	**Author Name**	**Publishing House,Volume, ISBN**
1	A Text Book of Internal Combustion Engine	Er. R.K.Rajput	Laxmi Publications (P) Ltd., New Delhi
2	Fundamentals of Internal Combustion Engines	H.N.Gupta	PHI Learning Pvt. Ltd., New Delhi
3	I C Engines	V.Ganesan	Wiley India Pvt. Ltd., New Delhi
4	Internal Combustion Engines Applied Thermosciences	Colin R Ferguson and Allan T. Kirkpatrick	Tata McGraw Hill Education, New Delhi
5	Internal Combustion Engine Fundamentals	John B. Heywood	Longmans Green and Co. INC, New York
6	Introduction to Internal Combustion Engines	Richard Stone	Macmillan Press Ltd., London

Course Code	**MEPE – 403**				
Category	Program Elective Course				
Course Title	**Welding Science and Technology**				
Scheme and Credits	**L**	**T**	**P**	**Credits, C**	**Semester – IV**
	3	0	0	**3**	
Pre-requisites (if any)	Basic Work Shop Practice				

Learning Objectives:

Students will be able to:

LO1	Demonstrate different types of welding processes.
LO2	Explain different weld joints design, welding methods, residual stress and distortion in welding.
LO3	Identify different microstructures in weldments.
LO4	Utilize different pre and post heat treatments in welding processes.
LO5	Explain chemical fusion and different arc welding processes.
LO6	Demonstrate non-consumable arc welding process and modern welding processes.
LO7	Illustrate different pressure, friction and diffusion welding process.
LO8	Explain weldability and its types.
LO9	Identify different types of weld defects in arc and other welding processes.
LO10	Identfy destructive and non-destructive tests in welding processes.

Course Outcomes:

On successful completion of the course students will be able to:

CO1	Demonstrate different types of welding, joint designs, stress and distortion.
CO2	Identify different types of zones in weldments, weld cracks, pre and post heat treatment process.
CO3	Identify different fusion welding process.
CO4	Explain non-fusion welding process and weldability.
CO5	Identify different types of weld defects and testing methods.

Detailed Syllabus:

Units	Detailed Contents	Contact Hour
UNIT-I	**Introduction to Welding:** Definition of Welding, Weldment, Soldering, Brazing; Comparison between welding, soldering and brazing; Concept of Joining Process – Autogenous Process, Homogeneous Process and Heterogeneous Process; Classification of Welding Process; Types of Weld Joints; Types of Welds; Welding Positions; Edge Preparation; Faying Surface; Welding Symbols; Welding Symbols for Different Types of Welds; Weld Location; Location Significance of Arrow; Factors affecting Weld Strength; Stresses in Weldment; Causes of Residual Stress; Methods adopted in Controlling Residual Stress; Distortion in Welds; Factors Responsible for Distortion; Types of Welding Distortion; Methods of controlling Distortion;	08 Hrs
UNIT-II	**Welding Metallurgy and Cracks in Welding:** Zones of Heat in Weldment; General Theory of Solidification of Metals and Alloys; Idea of Homogenous and Heterogenous Nucleation; Effects of Welding Speed on Grain Structure; Basic Idea of Fusion Boundary Zone and Heat Affected Zone (HAZ); Sub-division of HAZ; Properties of HAZ; Heat Treatment in Fusion Welding; Different Microstructure in Weldments; Causes of Weld Cracks; Classification of Weld Cracks; Basic Idea of Hot Cracks ; Factors affecting Hot Cracking; Basic Idea of Cold Cracks; Factors affecting Cold Cracking; Nomenclature of Weld Cracks; Basic Idea of Specific Cracks – Chevron Cracks, Lamellar Cracks, Reheat Cracks and Stress Corrosion Cracks; Heat Treatment in Welding – Definition of Preheat / Interpass Temperature, Aims of Preheating, Clip Test, Methods of Preheating, Advantages of Preheating, Post-weld Heat Treatment Process;	09 Hrs
UNIT-III	**Fusion Welding Process:** **Chemical Fusion Welding (Principles, Limitation & Applications):** Oxyacetylene Welding (OWA) – Principles of OAW, Types of Flame, Fluxes, Welding Equipment, Welding Pressure, Welding Methods. **Electric Arc Welding Process (Principles, Limitation & Applications): Consumable Electrode Arc Welding:** Principle of Arc Welding, Arc Crater, Arc Length, Metal Transfer in Arc Welding, Forces involved in Metal Transfer, Arc Welding Equipment, Welding Machine, Arc Welding Current and Voltage, Polarity, Electrodes; Shielded Metal Arc Welding, Gas Metal Arc Welding (GMAW), Submerged Arc Welding, Electro Slag Welding; **Non Consumable Electrode Arc Welding Process (Principles, Advantages, Limitation & Applications):** Gas Tungsten Arc Welding (GTAW), Difference between GMAW and GTAW, Plasma Arc Welding; Resistance Welding Process – Heat Produced in Resistance Welding, Spot, Seam and Projection Welding; Flash, Upset and Percussion Welding; Thermit Welding; **High Density Beam Welding (Principles, Advantages,**	14 Hrs

	Limitation & Applications): Laser Beam Welding and Electron Beam Welding.	
UNIT-IV	**Non-Fusion Welding Process and Weldability:** Principles of Non-Fusion Welding Process; Types of Non-Fusion Welding; **Pressure Welding Process:** Principle of Hot and Cold-Welding Process, Types of Hot and Cold-Welding Process; Explosion Welding Process; **Friction Welding Process:** Friction Stir Welding Process, Ultrasonic Welding Process; **Diffusion Welding;** Weldability: Definition, Types of Weldability Tests, Types of Actual Welding Tests; Types of Fabrication and Service Weldability Tests	08 Hrs
UNIT-V	**Weld Defects and Testing in Welding:** **Weld Defects –** Definition, Classification of Weld Defects, Arc Welding Defects, Other Welding Defects; **Destructive Testing –** Types of Destructive Testing, Tensile Testing, Ductility Testing, Toughness Testing, Fatigue Testing; **Non-destructive Testing:** Types of Non-destructive Testing, Visual Inspection; Equipment used in Visual Inspection, Liquid Penetrating Testing, Magnetic Particle Testing, Ultrasonic Testing.	06 Hrs
Total Contact Hours		**45 Hrs**

Table of Specification for Welding Science and Technology

Sl No	Contact Hours (48)	Units	Objective			Short Answer Type				Long Answers Type						Total Marks
			R	U	AP	R	U	AP	AN	R	U	AP	AN	E	C	
1	08	Unit I	1	2	0	2	2	0	0	6	6	0	0	0	0	**09**
2	09	Unit II	2	2	2	2	2	3	0	6	6	6	0	0	0	**10**
3	14	Unit III	2	1	2	2	2	3	0	6	6	6	0	0	0	**16**
4	08	Unit IV	1	2	0	2	2	0	0	6	6	0	0	0	0	**13**
5	06	Unit V	2	2	2	2	2	3	0	6	6	6	0	0	0	**12**
Total Marks			**5**	**5**	**5**	**4**	**7**	**3**	**0**	**6**	**13**	**12**	**0**	**0**	**0**	**60**

NB: R: Remember, **U:** Understand, **AP:** Apply, **AN:** Analyze, **E:** Evaluate, **C:** Create

Annexure-I (Welding Science and Technology)

Sl No.	Units	Time Allotted (Hrs)	Percentage Weightage	R	U	AP	AN	E	C	Total Marks
1	Unit I	08	15.00	9	10	0	0	0	0	**09**
2	Unit II	09	16.66	10	10	11	0	0	0	**10**
3	Unit III	14	26.66	10	9	11	0	0	0	**16**
4	Unit IV	08	21.66	9	10	0	0	0	0	**13**
5	Unit V	06	20.00	10	10	11	0	0	0	**12**
Total Marks		**45**	**100**	**15**	**25**	**20**	**0**	**0**	**0**	**60**

NB: R: Remember, **U:** Understand, **AP:** Apply, **AN:** Analyze, **E:** Evaluate, **C:** Create

Reference Book List:

Sl No.	Book Name	Author Name	Publishing House,Volume, ISBN
1	Welding Engineering and Technology	Dr R.S.Parmar	Khanna Publisher, New Delhi
2	Welding	A.C Davies	Wiley Eastern Pvt. Ltd., New Delhi
3	Principles of Welding Process, Physics, Chemistry and Metallurgy	Robert W. Messler, Jr.	Wiley-VCH Verlag GmbH & Co., Weinheim
4	Welding Engineering, An Introduction	David H. Philips	John Wiley & Sons, Ltd., UK
5	A Text Book of Manufacturing Technology	Er. R.K.Rajput	Laxmi Publications (P) Ltd.,, New Delhi
6	Welding Principles and Practices	Edward R. Bohnart	McGraw Hill LLC, New York
7	Metallurgy of Welding	J.F.Lancaster	Woodland Publishing Ltd., England

Course Code	**MEPE – 404**				
Category	Program Elective Course				
Course Title	**Automobile Engineering – I Laboratory**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-IV**
	0	0	2	**1**	
Pre-requisites (if any)	Basic knowledge of Internal Combustion Engine, Physics, Math, Chemistry, Engg. Mechanics.				

Learning Objectives:

Students will be able to:

LO1	Demonstrate layout of a chassis frame.
LO2	Demonstrate two-stroke and four-stroke petrol and diesel engine.
LO3	Demonstrate cut model of an automobile engine and its major parts.
LO4	Develop actual valve timing diagram of four-stroke petrol and diesel engine.
LO5	Demonstrate construction, working and operation of Solex type carburettor.
LO6	Make use of Cleveland apparatus to determine flash point and fire point of I.C engine fuel.
LO7	Demonstrate load test of four -stroke diesel engine with rope brake dynamometer.
LO8	Demonstrate constructional details, working and operation of a Radiator, Battery Ignition System and Magneto Ignition System.

Course Outcomes:

On successful completion of the course students will be able to.

CO1	Apply fundamental engineering principles and concepts to set up the experiment for investigation.
CO2	Select proper procedure with necessary tools and equipment for conducting the experiment.
CO3	Utilize correct working procedure for conducting experiment by following standard laboratory safety practices.
CO4	Demonstrate proficiency in collecting data/ representing data/ report writing/ viva-voce/ presentation along with handling laboratory equipment safely and correctly.
CO5	Examine the result of experimentation through the appropriate equations / formulae/ tools and techniques and publish/document.

List of Practices:

Sl. No.	Topics For Practices (Any eight experiments)	Contact Hours
1	To Study the constructional details and layout of an Automobile Chassis frame.	4
2	To study the constructional details, working principles and operation of two- stroke petrol Engine.	4
3	To study the constructional details, working principles and operation of four-stroke petrol Engine.	4
4	To study the constructional details, working principles and operation of four-stroke diesel engine.	4
5	To study constructional details of a cut model of an automobile engine.	4
6	To study constructional details of engine parts like crank shaft, cam shaft, spark plug, Piston and Cylinder, Inlet Manifold, Valves.	4
7	To study the actual valve timing diagram of four- stroke petrol engine.	4
8	To study the actual valve timing diagram of four- stroke diesel engine.	4
9	To study constructional details, working principles and operation of Solex type carburettor.	4
10	To study flash point and fire point of diesel engine by means of the Cleveland apparatus.	4
11	To determine the load test on a single cylinder four- stroke diesel engine with rope brake dynamometer.	4
12	To study constructional details, working and operation of a radiator.	4
13	To study constructional details & working of Battery Ignition System and Magneto Ignition System.	4
Total Hours		**30**

Reference Book Lists:

Sl No.	Book Name	Author Name	Publishing House, Volume, ISBN
1	A Text Book of Internal Combustion Engine	Er. R.K.Rajput	Laxmi Publications (P) Ltd., New Delhi
2	Automobile Engineering	Prof. R.B.Gupta	Satya Prakashan, New Delhi
3	Automobile Engineering	Kirpal Singh	Standard Publishers Distributors, New Delhi

Course Code	**MEPE – 405**				
Category	Program Elective Course				
Course Title	**Internal Combustion Engines Laboratory**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-IV**
	0	0	2	**1**	
Pre-requisites (if any)	Basic knowledge of Internal Combustion Engine				

Learning Objectives:

Students will be able to:

LO1	Demonstrate two-stroke and four-stroke petrol and diesel engine.
LO2	Develop actual valve timing diagram of four-stroke petrol and diesel engine.
LO3	Make use of Cleveland apparatus to determine flash point and fire point of I.C engine fuel.
LO4	Plan performance test on four-stroke diesel engine and prepare heat balance sheet.
LO5	Demonstrate load test of four -stroke diesel engine with rope brake dynamometer.
LO6	Apply Morse test to find IHP of multicylinder petrol/diesel engine.
LO7	Demonstrate carburettor and analyze exhaust gas on Orsat's meter.

Course Outcomes:

On successful completion of the course students will be able to.

CO1	Apply fundamental engineering principles and concepts to set up the experiment for investigation.
CO2	Select proper procedure with necessary tools and equipment for conducting the experiment.
CO3	Utilize correct working procedure for conducting experiment by following standard laboratory safety practices.
CO4	Demonstrate proficiency in collecting data/ representing data/ report writing/ viva-voce/ presentation along with handling laboratory equipment safely and correctly.
CO5	Examine the result of experimentation through the appropriate equations / formulae/ tools and techniques and publish/document.

List of Practices:

Sl. No.	Topics For Practices (Any eight experiments)	Contact Hours
1	To study the constructional details & working principles of two- stroke petrol Engine.	4
2	To study the constructional details & working principles of four-stroke petrol Engine.	4
3	To study the constructional details & working principles of four-stroke diesel engine.	4
4	To study the actual valve timing diagram of four- stroke diesel engine.	4
5	To study the actual valve timing diagram of four- stroke petrol engine.	4
6	To study flash point and fire point of diesel engine by means of the Cleveland apparatus.	4
7	To prepare heat balance sheet by conducting performance test on single cylinder 4 stroke diesel engine with electrical brake dynamometer.	4
8	To determine the load test on a single cylinder four- stroke diesel engine with rope brake dynamometer.	4
9	To find the indicated horse power (IHP) on multi-cylinder diesel engine / petrol engine by Morse test.	4
10	To study constructional details & working principles of Solex type carburettor.	4
11	Analysis of exhausts gases from single-cylinder/ multi-cylinder/ petrol engine by Orsat's apparatus.	4
Total Hours		**30**

Reference Book Lists:

Sl No.	Book Name	Author Name	Publishing House, Volume, ISBN
1	A Text Book of Internal Combustion Engine	Er. R.K.Rajput	Laxmi Publications (P) Ltd., New Delhi
2	Fundamentals of Internal Combustion Engines	H.N.Gupta	PHI Learning Pvt. Ltd., New Delhi
3	I C Engines	V.Ganesan	Wiley India Pvt. Ltd., New Delhi

Course Code	**MEPE – 406**				
Category	Program Elective Course				
Course Title	**Welding Science and Technology Laboratory**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-IV**
	0	0	2	**1**	
Pre-requisites (if any)	Basic Workshop Practice				

Learning Objectives:

Students will be able to:

LO1	Illustrate various welding terms and definition along with fusion and non-fusion welding equipment.
LO2	Demonstrate hands on practice of edge preparation for welding and striking an arc on a given work piece.
LO3	Explain the effect on arc striking and weld bead under different welding parameters.
LO4	Demonstrate hands on practice on preparing different weld joints and butt joint and explain different types of weld joints.
LO5	Explain various types of destructive and non-destructive weld tests.
LO6	Demonstrate nugget test on spot weld.
LO7	Demonstrate hands on practice of testing a pre-fabricated welding sample through appropriate destructive or non-destructive testing procedure.

Course Outcomes:

On successful completion of the course students will be able to:

CO1	Apply fundamental engineering principles and concepts to set up the experiment for investigation.
CO2	Select proper procedure with necessary tools and equipment for conducting the experiment.
CO3	Utilize correct working procedure for conducting experiment by following standard laboratory safety practices.
CO4	Demonstrate proficiency in collecting data/ representing data/ report writing/ viva-voce/ presentation along with handling laboratory equipment safely and correctly.
CO5	Examine the result of experimentation through the appropriate equations / formulae/ tools and techniques and publish/document.

List of Practices:

Sl. No.	Topics For Practices (Any eight experiments)	Contact Hours
1	To study welding terms and definition like arc blow, arc length, flux, shielded flux, electrode etc..	4
2	To study various fusion and non-fusion welding equipment.	4
3	To conduct edge preparation for various types of weld joints.	4
4	To conduct hands on practice of arc striking on Mild Steel Plate by different arc striking methods.	4
5	To perform arc striking on Mild Steel plate using different welding parameters.	4
6	To study the effect of welding parameters on weld bead.	4
7	To study different types of weld joints.	4
8	To prepare a Lap joint: T-joint, H-joint, Angular joints with mild steel strip using fusion/ non fusion welding processes.	4
9	To prepare a butt welding with mild steel strip using fusion/ non fusion welding process.	4
10	To study various non-destructive testing methods.	4
11	To study various types of destructive testing methods.	4
12	To perform nugget test for spot welding.	4
13	To perform destructive testing on a welding sample.	4
14	To perform non-destructive testing on a welding sample.	4
Total Hours		**30**

Reference Book Lists:

Sl No.	Book Name	Author Name	Publishing House, Volume, ISBN
1	Welding Engineering and Technology	Dr R.S.Parmar	Khanna Publisher, New Delhi
2	Welding Principles and Practices	Edward R. Bohnart	McGraw Hill LLC, New York
3	Welding Engineering, An Introduction	David H. Philips	John Wiley & Sons, Ltd., UK

Course Code	**MEOE – 401**				
Category	Open Elective				
Course Title	**Universal Human Values – II**				
Scheme and Credits	**L**	**T**	**P**	**Credits, C**	**Semester – IV**
	2	0	0	**2**	
Pre-requisites (if any)	UHV- I				

Learning Objectives:

Students will be able to.

LO1	Appraise Values and Skill Apply the understanding of ethical conduct to formulate the strategy for ethical life and profession.
LO2	Examine the role of human being in existence.
LO3	Analyze the basis for harmony or contradiction in the self.
LO4	Discover understanding of harmony in nature and existence.
LO5	Apply human conduct in a holistic way of living in self and in harmony with existence.

Course Outcomes:

On successful completion of the course students will be able to:

CO1	Assess the significance of value inputs in formal education and start applying them in their life and profession.
CO2	Identify to evaluate the role of harmony at all levels of existence – self, family, society and universal order.
CO3	Develop appropriate technologies and management patterns to create harmony and ethical conduct in professional and personal life.
CO4	Examine the role of a human being in ensuring harmony in society and nature.

Course Outcome (Course Skill Set):

By the end of the course, students are expected to become more aware of themselves, and their surroundings (family, society, nature); they would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind. They would have better critical ability. They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society). It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction. Therefore, the course and further follow up is expected to positively impact common graduate attributes like:

1. Holistic vision of life.
2. Socially responsible behaviour.
3. Environmentally responsible work.
4. Ethical human conduct.
5. Having Competence and Capabilities for Maintaining Health and Hygiene.
6. Appreciation and aspiration for excellence (merit) and gratitude for all.

Detailed Syllabus:

Units	Detailed Contents	Contact Hour
UNIT-I	**Introduction to Value Education**: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education), Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfil the Basic Human Aspirations.	06 Hrs
UNIT-II	**Right Understanding (Knowing)- Knower, Known & the Process:** Right Understanding of the knower and the doer, Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health.	06 Hrs
UNIT-III	**Harmony in the Family and Society:** Harmony in the Family – the basic unit of human interaction, 'Trust' – the foundational value in relationship, 'Respect' – as the right evaluation, Other feelings, Justice in human – to human relationship, Understanding harmony in the Society, Vision for the Universal Human Order.	06 Hrs

UNIT-IV	**Understanding Nature and Existence:** Understanding Harmony in the Nature, Interconnectedness, self-regulation and mutual fulfilment among the four orders of nature, Realizing existence as co-existence at all levels, The Holistic perception of Harmony in existence.	06 Hrs
UNIT-V	**Implications of the Holistic Understanding – a Look at Professional Ethics** Natural acceptance of Human Values, Definitiveness of (Ethical) human conduct, A basis for humanistic education, Humanistic constitution and Universal Human Order, Competence in professional ethics Holistic technologies, Production Systems and Management Models – Typical case studies, Strategies for transition towards value – based life and profession.	06 Hrs
Total Contact Hours		**30 Hrs**

Table of Specification for Universal Human Values – II

Sl No	Contact Hours (48)	Units	Objective			Short Answer Type				Long Answers Type						Total Marks
			R	U	AP	R	U	AP	AN	R	U	AP	AN	E	C	
1	06	Unit I	1	2	1	3	3	0	3	6	6	6	6	6	0	**10**
2	10	Unit II	2	1	1	3	3	3	0	0	6	0	0	0	0	**15**
3	08	Unit III	2	1	1	3	3	3	3	0	6	6	6	0	0	**15**
4	11	Unit IV	1	2	2	3	3	3	3	6	6	6	6	0	0	**10**
5	05	Unit V	2	1	2	3	3	3	0	0	6	6	0	0	0	**10**
Total Marks			**5**	**5**	**5**	**3**	**3**	**3**	**3**	**6**	**6**	**9**	**6**	**6**	**0**	**60**

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Annexure-I (Universal Human Values – II)

Sl No.	Units	Time Allotted (Hrs)	Percentage Weightage	R	U	AP	AN	E	C	Total Marks
1	Unit I	06	16.66	10	11	7	9	6	0	**10**
2	Unit II	06	25.00	5	10	4	0	0	0	**15**
3	Unit III	06	25.00	5	10	10	9	0	0	**15**
4	Unit IV	06	16.66	10	11	11	9	0	0	**10**
5	Unit V	06	16.66	5	10	11	0	0	0	**10**
Total		**30**	**100**	**14**	**14**	**17**	**9**	**6**	**0**	**60**

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Reference Book List:

Sl No.	Text Book Name	Author Name	Publishing House,Volume, ISBN
1	A Foundation Course in Human Values and Professional Ethics.	R R Gaur, R Asthana, G P Bagaria	Excel Books, New Delhi
2	Professional Ethics and Human Values	Premvir Kapoor	Khanna Book Publishing, New Delhi

References:

1. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins, USA
2. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
3. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986.
4. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.
5. A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.
6. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
7. A N Tripathy, 2003, Human Values, New Age International Publishers.
8. Subhas Palekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) Krishi Tantra Shodh, Amravati.
9. E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists &Engineers, Oxford University Press
10. M Govindrajran, S Natrajan& V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.
11. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
12. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008

Course Code	MEOE – 402				
Category	Open Elective Course				
Course Title	**Advanced Engineering Mathematics - II**				
Scheme and Credits	**L**	**T**	**P**	**Credits, C**	**Semester – IV**
	2	0	0	**2**	
Pre-requisites (if any)	Engineering Mathematics				

Learning Objectives:

LO1	Apply Improper Integrals in solving simple problems.
LO4	Apply Fourier series in solving simple problems.
LO5	Apply Laplace transformation and its inverse in solving differential equation.
LO6	Develop empirical laws and explain curve fitting from given data.
LO7	Explain Numerical Solution of Linear and Non-Linear Equations.

Course Outcomes:

CO1	Apply Improper Integrals in solving simple engineering problems.
CO2	Solve simple problems with Fourier Series.
CO3	Apply Laplace Transformation and its inverse in solving simple problems.
CO4	Apply various methods for Numerical Solution of Linear and Non-Linear Equations.

Detailed Syllabus:

Units	Detailed Contents	Contact Hour
UNIT-I	**Integral Calculus:** Improper Integrals, Kinds of Improper Integrals, Reduction Formula for Integrals, Leibnitz Integral Rule, Dirichlet Integrals. General Integration Formula, Trapezoidal Rule, Simpson's One-third Rule. Introduction of Double Integrals and simple problems.	06 Hrs

UNIT-II	**Fourier Series:** Periodic Functions – Definition, Period, Fundamental Period, Properties of Periodic Functions, Trigonometric Series, Fourier- Euler Formula, Fourier Series, Dirichlet's Conditions for a Fourier Series, Convergence Theorem, Determination of Fourier Coefficients, Advantages of Fourier Series, Concept of Even and Odd Functions; Fourier Series Expansions of Even and Odd Functions; Expansion of Fourier Series of Functions in an arbitrary Interval. Expansion of Half Range Sine and Cosine Series; Complex Form of Fourier Series.	08 Hrs
UNIT-III	**Laplace Transformation:** Definition, Sufficient Conditions for Existence of Laplace Transformation, Linearity of the Laplace Theorem, Transforms of Elementary Functions, Transforms of Periodic Functions, Transform of Special Function, Differentiation and Integration of Laplace Transforms. Inverse Transforms. Laplace Transform on Ordinary Differential Equations. Laplace Transforms on Partial Differentiations.	08 Hrs
UNIT-IV	**Numerical Methods:** **Empirical Laws and Curve Fitting:** Scatter Diagram, Curve Fitting, Graphical Method, Laws Reducible to the Linear Law, Principles of Least Square – Method of Least Squares, Fitting of Curves of Types $y = ax^b$, $y = ab^x$, $y = ax^b$; Standard Error of Estimate, Difference Operators and Symbolic Relations, Higher -order Difference Operators. **Numerical Solution of one- dimensional Non-linear Equations:** Bisection Methods, Method of False Position, Newton – Raphson Method; Numerical **Solution of Linear Simultaneous Equation** – Gauss Elimination Method, Gauss – Jordan Method.	08 Hrs
Total Contact Hours		**30 Hrs**

Table of Specification for Advanced Engineering Mathematics – II

Sl No	Contact Hours (48)	Units	Objective			Short Answer Type				Long Answers Type						Total Marks
			R	U	AP	R	U	AP	AN	R	U	AP	AN	E	C	
1	06	Unit I	1	2	1	3	3	3	0	6	6	6	0	0	0	**12**
2	08	Unit II	2	1	1	3	3	3	0	0	6	6	0	0	0	**15**
3	08	Unit III	2	1	1	3	3	3	0	0	6	6	0	0	0	**15**
4	08	Unit IV	1	2	2	3	3	3	0	6	6	6	0	0	0	**18**
Total Marks			**5**	**5**	**5**	**3**	**6**	**6**	**0**	**6**	**9**	**15**	**0**	**0**	**0**	**60**

NB: R: Remember, **U:** Understand, **AP:** Apply, **AN:** Analyze, **E:** Evaluate, **C:** Create

Annexure-I (Advanced Engineering Mathematics – II)										
Sl No.	**Units**	**Time Allotted (Hrs)**	**Percentage Weightage**	**R**	**U**	**AP**	**AN**	**E**	**C**	**Total Marks**
1	Unit I	06	20.00	3	10	10	0	0	0	**12**
2	Unit II	08	25.00	4	05	10	0	0	0	**15**
3	Unit III	08	25.00	4	05	10	0	0	0	**15**
4	Unit IV	08	30.00	4	10	11	0	0	0	**18**
Total		**30**	**100**	**14**	**20**	**26**	**0**	**0**	**0**	**60**

NB: R: Remember, **U:** Understand, **AP:** Apply, **AN:** Analyze, **E:** Evaluate, **C:** Create

Reference Book List:

Sl No.	**Book Name**	**Author Name**	**Publishing House,Volume, ISBN**
1	Advance Engineering Mathematics	H.C.Taneja	I.K. International Pvt. Ltd., New Delhi
2	Higher Engineering Mathematics	Dr B.S.Grewal	Khanna Publishers, New Delhi
3	Advanced Engineering Mathematics	H.K.Dass	S.Chand and Company Ltd., New Delhi
4	Advanced Engineering Mathematics	C.Ray Wylie	McGraw Hill Book Company, New Delhi
5	Advanced Engineering Mathematics	K.A.Stroud	Palgrave Macmillan, New York
6	Advanced Engineering Mathematics	Erwin Kreysig	John Wiley & Sons, INC, USA

Course Code	**MEPR – 401**				
Category	Minor Project				
Course Title	**Minor Project - I**				
Scheme and Credits	**L**	**T**	**P**	**Credits, C**	**Semester – IV**
	0	0	4	**2**	
Pre-requisites (if any)	Domain knowledge and methods of experimentation, fabrication and research				

Course Outcomes:

After successful completion of Mini Project students will be able to:

CO1	Identify engineering problems that are relevant to domain interest or society or industry.
CO2	Carry out literature survey in worthiness with the problem identification.
CO3	Identify appropriate technique to solve the problem identified after proper investigation.
CO4	Perform experimentation/ simulation/ programming/ fabrication and collection of data and its interpretation.
CO5	Demonstrate proficiency in documentation, presentation, preparation of technical report, viva-voce and leadership quality.

Detailed Syllabus:

Units	**Detailed Contents**	**Contact Hour**
UNIT-I	Brief idea on types of research, review of related literature, identifying and tackling a chosen problem, data collection tools and techniques, qualitative and quantitative data analysis, report writing, plagiarism, copyright, intellectual property right etc. that are relevant to chosen project work.	6 Hrs
UNIT-II	Project work	54 Hrs
Total Contact Hours		**60 Hrs**

INTERNAL ASSESMENT			
Sl No	**Assessment**	**Description**	**Marks**
1	Attendance	To follow attendance percentage guidelines for awarding marks to students by the project guide.	**10**
2	Discipline	As demonstrated by the student and assessed by the concerned project guide.	**2**
3	Project Report Assignment	To be submitted by student on a format as decided by the department following all the standard norms for a dissertation or thesis or project report.	**30**
4	Presentation	Student will deliver progress seminar from time to time on a date as decided by the concerned department.	**10**
5	Viva-Voce	Student will appear on a viva-voce examination before submission of the final report to the department on a date as decided by the head of the department.	**8**
TOTAL MARKS			**60**
N.B: Concerned departments may develop suitable rubrics against each descriptor of assessment to award mark to the students.			

END SEMESTER EXAMINATION			
Sl No	**Assessment**	**Description**	**Marks**
1	Presentation	Student will deliver final presentation of their project related work on a date as fixed by SCTE, Assam.	**15**
2	Viva-Voce	Student will appear on a viva-voce examination in the same day of final presentation on a date as fixed by SCTE, Assam	**25**
TOTAL MARKS			**40**

Course Code	**MESI – 401**				
Category	Student Internship				
Course Title	**Student Internship – I**				
Scheme and Credits	**L**	**T**	**P**	**Credits, C**	**Semester – IV**
	0	0	4	**2**	
Pre-requisites (if any)	Basic Engineering Knowledge				

Course Outcomes:

After completing student internship-I the student will be able to:

CO1	Explain the use of advanced tools and techniques available in industry and also industrial safety measures practiced in industry.
CO2	Utilize the internship experience in enhancing skill and setting future career goals and options.
CO3	Inspect the actual industrial process carried out in any departments of the organization in which the internship is chosen. .
CO4	Asses the value of skill, self-learning, leadership, intellectual capacity, judgement, credibility, intuition and professional ethics learnt within the work space of the organisation.
CO5	Demonstrate proficiency in report writing, personality development, presentation and viva-voce.

INTERNAL ASSESMENT			
Sl No	**Assessment**	**Description**	**Marks**
1	Attendance	Student will submit to the institute an attendance report duly signed by concerned person/ official in a format as decided by the institute.	10
2	Discipline	Student will submit to the institute a work conduct certificate duly signed by the concerned official from the industry on a format as decided by the institute.	2
3	Internship Report Assignment	Student will submit a report of industrial training undergone in the chosen industry and submit to the department in a format as decided by the concerned engineering department of the institute	30
4	Presentation	Student will submit individual presentation on power point to the concerned Engineering Department of the institute	10
5	Viva-Voce	Student will appear on a internal viva-voce in a date as decided by the head of the concerned department of the institute after completion of internship – I by the student.	8
TOTAL MARKS			**60**
N.B: Concerned departments may develop rubrics against each descriptor of internal assessment			

to award marks to the students.

END SEMESTER EXAMINATION			
Sl No	**Assessment**	**Description**	**Marks**
1	Presentation	Student will deliver presentation of their internship – I related works on a date as fixed by SCTE, Assam.	15
2	Viva-Voce	Student will appear on a viva-voce examination in the same day of presentation on a date as fixed by SCTE, Assam	25
TOTAL MARKS			**40**