Revised structure and syllabus of Part time Mechanical Engineering Department as CBCS (Revised) for implementation from forthcoming Academic Year 2022-23

Government College of Engineering, Aurangabad

(An Autonomous Institute)

Teaching and Evaluation Scheme from year 2022-23

Second Year B. Tech. (Part Time) Program in Mechanical **Engineering**

Semester III

Sr No	Category	Course Code	Course Title	Hours per week			Credits	Continuous Evaluation in terms of Marks				Total
				L	T	P		ISE I	ISE II	ISE III	ESE	
1.	BSC	MABS2001	Engineering Mathematics III	3	0	0	3	15	15	10	60	100
2.	PCC- I	MEPC2001	Engineering Thermodynamics	3	0	0	3	15	15	10	60	100
3.	PCC-III	MEPC2002	Manufacturing Processes	3	0	0	3	15	15	10	60	100
4.	PCC- I LC	MEPC2005	Lab- Engineering Thermodynamics	0	0	2	1	25			25	50
5.	PCC-III LC	MEPC2006	Lab-Manufacturing Processes (Workshop Practice II)	0	0	2	1	25			25	50
6.	OEC-I		**Open Elective-I**	3	0	0	3	15	15	10	60	100
7.	MC-II	EEMC2010	Environmental Studies	3	0	0	0	15	15	10	60	100
Total				15	0	4	14	125	75	50	350	600
Open Elective-I MEOE0010 Total Quality Management												

XV"BoS Mechanical Engineering Department held on 08/02/2022

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Semester IV

Sr No	Category	Course Code	Course Title	Hours per week			Credits	Continuous Evaluation in terms of Marks				Total
				L	T	P		ISE I	ISE II	ISE III	ESE	
1.	PCC-IV	MEPC2003	Mechanisms of Machine	3	0	0	3	15	15	10	60	100
2.	ESC	MEES2004	Materials Science and Metallurgy	3	0	0	3	15	15	10	60	100
3.	PCC-IV LC	MEPC2007	Lab- Mechanisms of Machine	0	0	2	1	25			25	50
4.	ESC - LC	MEES2008	Lab - Materials Science and Metallurgy	0	0	2	1	25			25	50
5.	PEC-I		**Professional Elective-I**	3	0	0	3	15	15	10	60	100
6.	PEC-I	MEPE2020	Lab- **Professional Elective- I** (Workshop Practice III)	0	0	2	1	25			25	50
7.	OEC-II		**Open Elective II**	3	0	0	3	15	15	10	60	100
Total				12	0	6	15	135	60	40	315	550

Professional Elective-I
MEPE2014 Machine Tools
MEPE2015 Production Processes

Open Elective II
MEOE1020 Automation Engineering

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Semester V

Sr No	Category	Course Code	Course Title	Hours per week			Credits	Continuous Evaluation in terms of Marks				Total
				L	T	P		ISE I	ISE II	ISE III	ESE	
1.	PCC-V	MEPC2010	Applied Thermodynamics	3	0	0	3	15	15	10	60	100
2.	PCC-II	MEPC2011	Machine Drawing	3	0	0	3	15	15	10	60	100
3.	PCC-VII	MEPC2012	Strength of Materials	2	0	0	2	10	10	5	25	50
4.	PCC-VIII	MEPC2013	Metrology & Quality Control	3	0	0	3	15	15	10	60	100
5.	PCC-VLC	MEPC2016	Lab- Applied Thermodynamics	0	0	2	1	25			25	50
6.	PCC-IILC	MEPC2017	Lab-Machine Drawing	0	0	2	1	25			25	50
7.	PCC-VII - LC	MEPC2018	Lab – Strength of Materials	0	0	2	1	25			25	50
8.	PCC-VIII LC	MEPC2019	Lab- Metrology & Quality Control	0	0	2	1	25			25	50
Total				11	0	8	15	155	55	35	305	550

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MABS2001: Engineering Mathematics-III (For Civil, Mechanical)	
Teaching Scheme **Lectures : 2Hrs/Week** **Tutorial : 1Hr/Week** **Total Credits 3**	**Examination Scheme** **ISE-I : 15 Marks** **ISE-II : 15 Marks** **ISE-III : 10Marks** **End Semester Exam : 60 Marks**

Course description:

MABS 2001 Engineering Mathematics-III is a compulsory course to second year engineering students of Civil and Mechanical of the institute in the Semester –III and is a continuation of previous year courses viz. MABS1001: Engineering Mathematics-I and MABS1002: Engineering Mathematics-II. This course intends to provide engineering students a coherent and balanced account of major mathematical techniques and tools.

Course Objective:

This course intends to provide an overview of analytical and numerical techniques to solve ordinary and partial differential equations, which we apply to solve many engineering problems.

Course Outcomes:

After completing the course, students will be able to:

CO1	Define linear differential equations (LDE), Cauchy's and Legendre's differential equations,first order partial differential equations, Lagrange's equation
CO2	Summaries the solution of LDE with constant and variable coefficients, solution of homogeneous and non-homogeneous PDE,
CO3	Find approximate solution of ordinary differential equations of first order
CO4	Solve linear differential equations with constant and variable coefficients,first order linear and nonlinear partial differential equations, second order homogeneous and non-homogeneous linear partial differential equations.
CO5	Apply knowledge of linear differential equations to civil engineering problems, electrical circuits and Spring-Mass system, partial differential equations to wave equations and heat equations.

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Detailed syllabus:

Unit-I	**The approximation for the solution of first order Ordinary Differential Equations:** Taylor series method, Euler's method, Euler's modified method, Runge-Kutta fourth order method, Milne's Predictor-Corrector method.	06 L+ 03T
Unit-II	**Linear Differential Equations (LDE):** Linear differential equations **(LDE)** with constant coefficients, method of variation of parameters second order linear differential equations with variable coefficients, Cauchy's and Legendre's differential equations.	06 L+ 03T
Unit-III	**Applications of Linear Differential Equations (LDE):** Bending of beams, spring-mass system.	02 L+ 01T
Unit-IV	**Partial Differential Equations (PDE):** first order linear/nonlinear partial differential equation, Lagrange's equation, solution to homogenous and non-homogenous linear partial differential equations of second and higher order by complimentary function and particular integral method.	06 L+ 03T
Unit-V	**Applications of Partial Differential Equations:** Method of separation of variables, solutions of one-dimensional wave equation, one-dimensional heat equation, steady state solution of two-dimensional heat equation.	04 L+ 02T

Text and Reference Books

1. Erwin Kreyszig, "*Advanced Engineering Mathematics*", Willey Eastern Ltd. Mumbai.
2. B. S. Grewal, "*Higher Engineering Mathematics*" Khanna publication, New Delhi.
3. Ravish R Singh, Mukul Bhatt, "*Engineering Mathematics-A Tutorial Approach*"
4. H. K. Dass, "*Advanced Engineering Mathematics*" S. Chand and Sons.
5. G. B. Thomas and R. L. Finney, "*Calculus*", Addison- Wesley, 1996
6. I.N. Sneddon, "*Elements of Partial Differential Equation*"
7. Boyce &DiPrima, "*Elementary Differential Equations and Boundary Value Problems*"

Mapping of Course outcome with Program Outcomes (Civil Engineering)

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1										1
CO2	3	1										1
CO3	3	2	1									1
CO4	3	2										1
CO5	3	2										1

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Mapping of Course outcome with Program Outcomes (Mechanical Engineering)

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1										1
CO2	3	1										1
CO3	3	2	1									1
CO4	3	2										1
CO5	3	2										1

3 – High, 2 – Medium, 1 - Low

Teaching Strategies:

The teaching strategy planned through the lectures, and team-based homew o r k . Exercises assigned weekly to stimulate the students to actively use and revise the learned concepts, which also help the students to express their way of solving the problems fluently in written form. Most critical concepts and mistakes emphasized

Assessment:

ISE I: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/Presentations/ Course Projects on First and Second unit.

ISE II: Shall be based on class test on third and fourth units.

ISE III: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/Presentations/ Course Projects on Fifth unit.

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I (Class Test-1)	ISE II (Class Test-2)	ISE III (TA + Surprise Test)	End Semester Examination
K1	Remember	01	02		
K2	Understand	14	13	10	60
K3	Apply				
K4	Analyze				
K5	Evaluate				
K6	Create				
Total Marks 100		15	15	10	60

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MEPC2001: ENGINEERING THERMODYNAMICS		
Teaching Scheme	**Examination Scheme**	
Lectures: 03 hrs./ week	**ISE I**	**15 Marks**
Tutorial: 00 hrs./ week	**ISE II**	**15 Marks**
Credits: 03	**ISE III**	**10 Marks**
	End Semester Examination	**60 Marks**

Prerequisites: PHBS1001 Engineering physics, CHBS 1001 Engineering Chemistry, MABS 1001 Engineering Mathematics, MEES1003 Basics of Mechanical Engineering

Course description: This course consists of basic understanding and application of laws of engineering thermodynamics to the various practical engineering applications like engines, power plants, heat exchangers, pumps etc. Basic understanding of steam formation, steam properties and use of steam tables and Mollier diagram is included in this course. Theoretical analysis of various air standard cycles is covered in this course. This course includes theoretical and practical analysis of fuels and products of combustion process.

Course Outcomes:
After completing the course, students will be able to:

	Course Outcomes
CO1	Study thermodynamic systems by applying laws of thermodynamics
CO2	Define state of steam and perform steam property calculations
CO3	Analyze thermodynamic cycle performance
CO4	Analyze combustion of fuels and product of combustion

Detailed Syllabus:

Unit 1	**First Law applied to Steady Flow Processes** steady flow processes, SFEE, modification of SFEE for different engineering devices such as nozzles, blowers, I.C. Engines, Compressors, Pumps, Turbines, throttling devices (Numerical Treatment) **Second Law of Thermodynamics** Limitations of first law of thermodynamics, Kelvin Planks, Clausius statement and their equivalence, PMM2, thermodynamic temperature scale, Energy, Energy as property of system, Entropy, entropy as a property, reversible process and irreversible process, (Numerical Treatment)
Unit 2	**Properties of steam and pure substances** Phase transformation, p-v phase diagram, critical point, Triple point, Enthalpy and Entropy of steam, steam tables, processes of steam, Enthalpy- Entropy diagram, steady flow process and determination of dryness fraction of steam (Numerical Treatment)

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Unit 3	**Power cycles** Definition of cycles, power producing cycles and power consuming cycles, Air standard cycles, air standard efficiency, Carnot cycle, Otto cycles, Diesel cycles, Dual combustion cycles, Comparison of Otto, Diesel and dual combustion cycles, Fuel air cycle, Brayton cycles (Numerical Treatment)
Unit 4	**Fuels and Combustion** classification of fuels, calorific value (C.V.) of fuels, Determination of C.V. of fuels: Dulongs formula, Bomb calorimeter and Boys Gas Calorimeter, Orsat apparatus and determination of minimum air required for combustion. Conversion of volumetric analysis to mass analysis, (Numerical Treatment)

Text and Reference Books

1. Nag P.K., "*Engineering Thermodynamics*", Fourth Edition, TMH Publishing Co. New Delhi, 2008
2. Ballaney P.L., "*Thermal Engineering*", Khanna Publications, New Delhi, 2014
3. Rajput R.K., "*A Textbook of Engineering Thermodynamics*", Third Edition, Laxmi Publication, New Delhi 2007
4. Domkundwar S, Kothandaraman C. P. & Domkundwar A., "*A Course in Thermal Engineering*", Dhanpat Rai and Co. publication, New Delhi, 2004
5. Rao Y. V. C., "*Engineering Thermodynamics*", Universities Press, Hyderabad 2014

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

3 – High 2 – Medium 1 - Low

Course outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	1			1	2		1	1		1	2	1
CO2	3	2	1			1	2		1	1		1	2	1
CO3	3	2	1			1	2		1	1		1	2	1
CO4	3	2	1			1	2		1	1		1	2	1

Assessment:

ISE I: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/Presentations/ Course Projects on First and Second unit.

ISE II: Shall be based on class test on third and fourth units.

ISE III: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/Presentations/ Course Projects on Fifth unit.

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Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	5	5		10
K2	Understand	5	5	3	20
K3	Apply	5	5	2	20
K4	Analyze			5	10
K5	Evaluate				
K6	Create				
Total Marks 100		15	15	10	60

Assessment table:

Assessment Tool	**K1 and K2**	**K2 and K3**	**K2 and K3**	**K2 and K3**
	CO1	CO2	CO3	CO4
ISE I (15 Marks)	7	8		
ISE II (15 Marks)			8	7
ISE III (10 Marks)	2	2	3	3
ESE Assessment (60 Marks)	20	20	20	20
Total Marks 100	29	30	31	30

Special Instructions if any: Nil

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MEPC2002 : MANUFACTURING PROCESSES		
Teaching Scheme	**Examination Scheme**	
Lectures: 03 hrs/ week	**ISE I**	**15 Marks**
Tutorial: 00 hrs/ week	**ISE II**	**15 Marks**
Credits:03	**ISEIII**	**10 Marks**
	ESE	**60 Marks**

Prerequisites: ME 1001 Basics of Mechanical Engineering

Course description:

After completing this course, students will have a broad and fundamental understanding of the concepts of moulding in practice, knowledge of pattern making and related concepts, concept of plastic processing, knowledge of hot and cold working processes, concept of sheet metal and joining process.

Course Outcomes:

After completing the course, students will be able to:

	Course Outcomes
CO1	Interpret foundry practices like pattern making and core making.
CO2	Interpret foundry practices like moulding.
CO3	Classify different plastic molding processes, fabricating methods of plastic, lamination and joining of plastic.
CO4	Differentiate various metal forming processes such as Hot and Cold working, Rolling, Forging, Extrusion and Drawing Processes.
CO5	Identify appropriate Joining Processes to join work piece.

Detailed Syllabus:

Unit 1	**Pattern Making** Introduction, pattern materials, factors affecting selection of pattern materials, master patterns, pattern allowances, types of patterns and their applications, core, core print, core boxes.
Unit 2	**Mould Making** Introduction, moulding sands, types of moulding sand, grain shape and size of sand, sand additives, properties of moulding sand, moulding processes, moulding processes based on sand used, making a green sand mould, typical moulding problems, machine moulding, cleaning of casting

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Unit 3	**Casting** Design considerations of castings, Various types of castings such as sand casting permanent mould or gravity die casting, semi-permanent mould casting, slush casting pressed casting, die casting, centrifugal casting, investment of lost wax casting, plaste mould casting, antioch casting, continuous casting, chill casting, malleable casting and their industrial applications, casting defects.
Unit 4	**Plastics and Their Processing** Plastic, its advantages and disadvantages. Thermoplastic and thermosetting plastics. Plastic processing methods such as compression moulding, transfer moulding, injection moulding, extrusion, casting, slush moulding and calendaring. Plastic fabricating methods such as blow moulding and forming. Lamination of plastics. Joining of plastics. Industrial applications of various plastic processes.
Unit 5	**Mechanical Working of Metals** Introduction to hot working. Hot working processes such as hot rolling, types of hot rolling mills, piercing of seamless tubing, drawing, deep drawing, hot spinning, cold working, cold rolling, cold drawing, cold bending, cold spinning. Industrial applicationsof various hot working and cold working processes. Introduction, forging materials, forging processes, hand forging, power forging, impression die forging, drop hammers, press forging, roll die forging press verses hammer forging, machine or upset forging, high energy rate forging, effects of forging, defects in forging, advantages and disadvantages.

Text and Reference Books

1. DeGarmo, Black Konser, "*Materials and Processes in Manufacturing*", PHI, New Delhi2008.
2. Schey J. A., "*Introduction to Manufacturing processes*", Mc Graw Hill, New Delhi 1999.
3. Lindberg A., "*Processes and Materials of Manufacturing*", Lindberg 1998.
4. Raghuvanshi B.S., "*Workshop Technology*", Vol I, Asia Publishing House 2008.
5. Hazra Choudhary, "*Elements of Workshop Technology*", Vol. I, Khanna Publishers 2008.
6. Bawa H.S., "*Workshop Technology*", Vol. I Mc Graw Hill, New Delhi, 2010.
7. Chapman W A J, "*Workshop Technology*", Taylor and Francis pub, Vol.1 and Vol. 2, Ed.5th, 2015

Assessment:

ISE I: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/Presentations/ Course Projects on First and Second unit.

ISE II: Shall be based on class test on third and fourth units.

ISE III: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/Presentations/ Course Projects on Fifth unit.

Mapping of Course outcome with Program Outcomes and Program SpecificOutcomes
3 – High 2 – Medium 1 - Low

Course outcome	PO1		PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1		3										3	1	3	
CO2	1		3										3	1	3	
CO3	1		3										3	1	3	
CO4	1		3										3	1	3	
CO5	1		3										3	1	3	

Assessment Pattern:

Assessment Pattern Level No.	**Knowledge Level**	**ISE I**	**ISE II**	**ISE III**	ESE
K1	Remember	5	5	2	20
K2	Understand	5	5	3	20
K3	Apply	5	5	2	10
K4	Analyze			3	10
K5	Evaluate				
K6	Create				
Total Marks 50		15	15	10	60

Assessment table:

Assessment Tool	**K3**				
	CO1	CO2	CO3	CO4	CO5
ISE I (15 Marks)	7	8			
ISE II (15 Marks)			7	8	
TA (10 Marks)	2	2	2	2	2
ESE (60 Marks)	20	10	10	10	10
Total Marks 100	29	20	19	20	12

Special Instructions if any: Nil

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MEPC2003 : MECHANISMS OF MACHINES		
Teaching Scheme	**Examination Scheme (Semester – I) Theory**	
Lectures: 03 hrs/ week	**ISE I**	**15 Marks**
Tutorial: 0 hrs/ week	**ISE II**	**15 Marks**
	ISE III	**10 Marks**
Credits:03	**End Semester Examination**	**60 Marks**

Pre-requisites: MA1001: Engineering Mathematics I, ME1001: BME, MA1002: Engineering Mathematics II.

Course Description:

The course is aimed at giving the fundamentals and application of kinematics in the analysis and synthesis of linkages, cams and gear trains. The design process is introduced and used to solve unstructured design problems in linkage, cam design and gear trains. Algebraic and graphical techniques to analyze the displacement, velocity and acceleration of linkages and cams are developed. Design considerations in mechanism synthesis.

Course outcomes: At the end of the course, the student will be able to:

CO1	Understand kinematics, kinematics links and its applications and apply concepts to analyze various types of linkage mechanisms used in obtaining specific motion
CO2	Apply the knowledge of velocity and acceleration analysis of linked mechanisms to formulate, understand motion to analyze and solve practical problem.
CO3	Understand the cam mechanism, its motions and accelerations and the geometry of cam profiles for analysis of engineering problems related to cam mechanisms
CO4	Apply knowledge of gears, gearing action in practice to analyze various motion transmission elements like gears, gear trains.

Detailed Syllabus:

Unit 1	**Kinematics:** Classification of mechanisms- Basic kinematic concepts and definitionsKinematic links, Kinematic pairs, Kinematic chains, planar, spherical, and spatial mechanisms, mobility, kutzbach criteria, Grubler criteria, problems based on above criterion Degree of freedom, mobility- Grashof's law, Kinematic inversions of four bar chain and slider crank chains- Limit positions- Mechanical advantage- Transmission angleDescription of some common mechanisms- Quick return mechanism, straight line generators- Universal Joint- Rocker mechanisms
Unit 2	**Velocity analysis of simple mechanisms:** Graphical velocity analysis using instantaneous centers, Arnold Kennedy's theorem, method of determining linear velocity of a point on a link, angular velocity of a link: link to link method, line of centers method. Linear and angular velocities using Relative velocity method, rubbing velocity at a pin Joint

Unit 3	**Acceleration Analysis:** Centripetal or radial acceleration, tangential acceleration, total acceleration of a point on link, method to obtain acceleration polygon for a mechanism, angular acceleration of link, acceleration of intermediate and offset points, slider crank mechanism, Coriolis acceleration component, crank and slotted lever mechanism Short cut methods for kinematic analysis of mechanism: Klein's construction, Ritterhaus's construction, Bennett's construction modified Kleins construction for four bar mechanism.
Unit 4	**Cams:** Classification of cams and follower, Terminology and definitions- Displacement Diagrams-Uniform velocity, parabolic, simple harmonic and cycloidal motions, Analysis of follower motion: constant/uniform velocity, SHM, constant/uniform acceleration & deceleration/retardation, cycloidal, polynomial motion & derivation, graphical synthesis of plate cams using knife edge, roller follower, radial / off-set follower, translating / oscillating motion of follower, determination of velocity & acceleration for this motion.
Unit 5	**Gears:** Gear terminology, types, field of application, Spur gear: condition for correct gearing, conjugate profiles, Involutes and cycloidal gear profiles, gear parameters, Comparison Between Involute and Cycloidal Gears. Fundamental law of gearing and conjugate action, spur gear contact ratio and interference/undercutting, methods of eliminating interference, determination of length of path of contact, length of path and arc of approach and recess, helical, bevel, worm, rack & pinion gears, epicyclic and regular gear train kinematics

Text and Reference Books

1. Shigley J. E. and Uicker J. J., "*Theory of Machines and Mechanisms*", 3rd Edition, McGraw Hill Intl, 2010.
2. Thomas Bevan, *Theory of Machines*, 3rd edition, CBS Publishers & Distributors, 2005.
3. Robert L. Norton, *Kinematics and Dynamics of Machinery*, Tata McGrawHill, 2009.
4. Rao J. S. & Dukkipati R. V., "*Mechanism and Machine Theory*", 2nd Edition, New AgeIntl. Publishers, 2012.
5. Ratan S. S., "*Theory of Machines*", 2nd Edition, Tata McGraw Hill Publishing Company Ltd, 2005.
6. Sharma C. S. and P. Kamlesh, "*Theory of Mechanisms and Machines*", Printice Hall of India Pvt. Ltd, 2006.
7. Ghosh A. and Mallick A.K., "*Theory of Mechanisms and Machines*", Affiliated East-WestPvt. Ltd, New Delhi, 1988.

Assessment:

ISE I: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/Presentations/ Course Projects on First and Second unit.

ISE II: Shall be based on class test on third and fourth units.

ISE III: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/Presentations/ Course Projects on Fifth unit.

Mapping of Course outcome with Program Outcomes

Course Out come	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2				3								1
CO2	1	2	3	3		2								
CO3	2	3	2	3		3							2	
CO4	3	1	2	1		3					3			

3 – High 2 – Medium 1 – Low

Assessment Pattern:

Assessment Pattern Level No.	**Knowledge Level**	**ISE I**	**ISE II**	**ISE III**	**End Semester Examination**
K1	Remember	2.5	2.5	00	10
K2	Understand	05	05	05	25
K3	Apply	7.5	7.5	05	25
K4	Analyze	00	00	00	00
K5	Evaluate	00	00	00	00
K6	Create	00	00	00	00
Total Marks 100					

Assessment table:

Assessment Tool	**K3**				
	CO1	CO2	CO3	CO4	CO5
ISE I (15 Marks)	05	05	05	00	
ISE II (15 Marks)	00	05	05	05	
ISE III (10 Marks)	02	03	02	03	
ESE Assessment (60 Marks)	15	15	15	15	
Total Marks 100	22	28	27	23	

Special Instructions if any:

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MEPC2004 : MATERIAL SCIENCE AND METALLURGY		
Teaching Scheme	**Examination Scheme**	
Lectures: 03 hrs./ week	**ISE I**	**15 Marks**
Tutorial: 0 hrs./ week	**ISE II**	**15 Marks**
Credits: 3	**ISE III**	**10 Marks**
	End Semester Examination	**60 Marks**

Prerequisites: NIL

Course Description: After completion of the course, students will be able to learn about the materials and its composition. Students will have basic and fundamental knowledge in the field of Material Science. They will be able to understand the effect of different metallurgical processes on the properties of materials. Students will get exposure to various Heat treatments and understanding the concept of Nonferrous Alloys and Bearing Materials.

Course Outcomes:

After completing the course, students will be able to:

	Course Outcomes
CO1	Explain the importance of materials properties and identify the material for specific applications. Understand distinguish microstructure and analyze the effect of Crystalline nature of metals.
CO2	Explain the construct Iron-Iron carbide equilibrium diagram and analyze microstructure, general properties.
CO3	Identify and understand different types of steel and its application. Heat treatment practices of commercial steels and alloy steels.
CO4	Analyze and implement suitable heat treatment processes.
CO5	Identify and analyze different cast iron and non-ferrous alloys according to their properties.

Detailed Syllabus:

Unit 1	**Introduction to materials & Metallography: -** Classification of materials. Properties and applications of materials, Evaluation of tensile and hardness, Classification of metallurgy as Ferrous and Non-Ferrous Metallurgy, Crystal System, Bravais Lattices and Crystal Imperfection, Alloys and solid solutions, types, and their formations, Hume-Rothery's rules, modified Gibbs's phase rule, Metallography, specimen preparation, optical metallurgical microscope.

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Unit 2	**Equilibrium Diagrams** for systems like isomorphous, eutectic, peritectic. Lever rule for phase mixtures and their application in system. Types of cooling curves. Iron-Iron carbide equilibrium diagram, Allotropy, cooling curve of pure iron, Critical temperatures. Microstructure of slowly cooled steels. Estimation of carbon from microstructures; Property variation with microstructure.
Unit 3	**Steel & Alloy steel: -**Classification and application of plain carbon steels. Classification and applications of steels. Specification of steels, Effect of alloying elements. Examples of alloy steel such as Hadfield Manganese Steel, ball Bearing Steels, etc. Tool Steels – Classification, composition, application and commercial heat treatment practices for HSS. Stainless steels Classification, composition, application
Unit 4	**Necessity of Heat Treatment**: - Transformations of steels during heating and cooling, non-equilibrium cooling and transformation products of austenite, TTT diagrams, different hardening methods, quenching media, tempering of plain carbon steels and its effects. Other H.T like annealing, normalizing. Concept of hardenability, critical diameter,end quench test, surface/ case hardening, Flame and induction hardening, solid, liquid and gas carburizing, nitriding, carbonitriding, Relative merits and demerits.
Unit 5	**Cast Iron** – Classification, Various types of cast iron, properties and applications. **Non-Ferrous Alloys** – Study of non-ferrous alloys such as Brass, Bronze, Aluminium & its alloys , Nickel & its alloy, Bearing materials with their properties and applications. **Composite Materials-** Introduction, classification, Particle-reinforced composites, Fibre-reinforced composites, Fibre glass- reinforced composite, Structural composites, protective coatings.

Text and Reference Books

1. V.Raghvan," *Material Science and Engineering*," PHI Publication, 2015.
2. V.D Kodgire, "*Metallurgy and Material Science*," Everest Publication, 2011.
3. S.Avner, " *Physical Metallurgy*," McGraw Hill Publication, 2017.
4. Callister," *Material science and Engineering*," Wiley Publication, 2014.
5. Dieter." *Mechanical Metallurgy*," McGraw Hill Publication, 2017.
6. ASM Handbook Vol. 12 Material Characteristics
7. ASM Handbook Vol. 12 Properties andSelection, 2017.
8. Dr. B. K. Agrawal, "*Introduction to Engineering Metallurgy*," Tata McGraw-Hill, 21strevised edition, 2007.

Assessment:

ISE I: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/Presentations/ Course Projects on First and Second unit.

ISE II: Shall be based on class test on third and fourth units.

ISE III: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/Presentations/ Course Projects on Fifth unit.

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

3 – High 2 – Medium 1 - Low

Course outcome	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	2											
CO2		3				2								
CO3	3				2							1	1	
CO4													3	3
CO5	3			1		2						1	2	

Assessment Pattern:

Assessment Pattern Level No.	**Knowledge Level**	**ISE I**	**ISE II**	**ISE III**	**End Semester Examination**
K1	Remember	3	3	2	15
K2	Understand	3	3	2	10
K3	Apply	2	2	2	15
K4	Analyze	3	3	2	10
K5	Evaluate	2	2		5
K6	Create	2	2	2	5
Total Marks 100		15	15	10	60

Assessment table:

Assessment Tool	**K3**				
	CO1	CO2	CO3	CO4	CO5
ISE I (15 Marks)	7	8			
ISEII (15 Marks)			7	8	
ISEIII (10 Marks)	2	2	2	2	2
ESE Assessment (60 Marks)	12	12	12	12	12
Total Marks 100	21	22	21	22	14

Special Instructions if any:

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MEPC2005 : LAB- ENGINEERING THERMODYNAMICS		
Teaching Scheme	**Examination Scheme**	
Practical: 2Hrs/Week	**ISE I**	**25 Marks**
Credits:01	**End Semester Evaluation**	**25 Marks**

Course Outcomes:

After completion of this course students will be able to:

	Course Outcomes
CO1	Understand the function of boiler and its mountings and accessories
CO2	Experimentally measure the calorific value and exhaust gas analysis
CO3	Experimentally measure the dryness fraction of steam using calorimeter
CO4	Communicate effectively by preparing laboratory and industry visit report

List of the Experiments

The student shall perform minimum eight experiments of the following

Sr. No.	Title of the Experiments	Skill / Knowledge Level	CO
1	Study of any two boilers: a) Babcock and Wilcox boiler and Benson boiler.	K2	CO1 and CO4
2	Study of mountings and accessories of boilers.	K2	CO1 and CO4
3	Study and determination of C.V. of solid fuel using Bomb Calorimeter.	K3	CO2 and CO4
4	Study and determination of C.V. of gaseous fuels using Boy's Gas calorimeter	K3	CO2 and CO4
5	Analysis of exhaust gases using NDIR apparatus.	K3	CO2 and CO4
6	Determination of dryness fraction of steam using tank calorimeter.	K3	CO3 and CO4
7	Determination of dryness fraction of steam using separating and throttling calorimeter.	K3	CO3 and CO4
8	Visit to industry related to thermodynamics (e.g., power plant, milk processing plant , cold storage)	K2	CO4

Assessment: ISE I

The ISE I will consist of submitting a file for all the experiments with neatly written recordsof the study and diagrams.

The term work will be assessed by the course coordinator

End Semester Evaluation

The End Semester Evaluation will comprise of viva voce on the conducted practicals.The End Semester Evaluation will be done by two examiners, one will be the course coordinator and other will be examiner appointed by DSB

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	End Semester Examination
K1	Remember	05	5
K2	Understand	10	10
K3	Apply	10	10
K4	Analyze		
K5	Evaluate		
K6	Create		
Total Marks		25	25

Assessment Pattern Level No.	Knowledge Level	ISE I	End Semester Examination
S1	Imitation	5	10
S2	Manipulation	10	8
S3	Precision	10	7
S4	Articulation		
S5	Naturalization		
Total Marks		25	25

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3					3	3		1	1	3	3	1	2
CO2	1	1				2	3		1	1	3	3	1	2
CO3	1	1				2	3		1	1	3	3	1	2
CO4	3	2				3	3	3	1	1	2	1	1	2

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MEPC2006 : WORKSHOP PRACTICE- II		
Teaching Scheme	**Examination Scheme**	
Practical: 4Hrs/Week	**ISE I**	**50 Marks**
Credits:02	**End Semester Evaluation**	**50 Marks**

Course Outcomes:

After completion of this course students will be able to:

	Course Outcomes
CO1	Acquiring the skills in machining operations like turning, milling, welding and black smithy.

List of the Experiments

Sr. No.	Title of the Experiments	Skill / Knowledge Level	CO
1	**Foundry Shop:** Sand moulding, types of sands, preparing sand for moulding, equipment, sand moulds (cope, drag, check etc.), safety precaution etc. **Job:** preparing sand moulds for single, multi-piece pattern in at least two- or multi--piece moulding boxes and details like runners, risers, gates etc. mould cavity finishing, demonstration of casting using ferrous of non-ferrous metal. precaution etc.	S2	CO1
2	**Welding Shop:** Different welding machines and equipment, types of welding and welded joints, used in fabrication, preparation for weld joints, joint finishing, different tools, types of electrodes, angle cutters, portable grinder, drills, safety precautions etc. **Job:** Preparing a job individually or in a group of students of any useful item of daily use using various welding operations Introduction and demonstration of robotic welding.	S3	CO1
3	**Industrial Visit to any plastic manufacturing industry**	S4	CO1
4	**Industrial visit to any sheet metal working industry and study its process.**	S5	CO1

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Assessment:

ISE I

The ISE I will consist of submitting job of the sections with neatly written recordsof the study and diagrams. The term work will be assessed by the course coordinator

End Semester Evaluation

The End Semester Evaluation will comprise of viva voce by conducting practical exam.The End Semester Evaluation will be done by two examiners, one will be the course coordinator and other will be examiner appointed by DSB

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	End Semester Examination
K1	Remember	5	5
K2	Understand	5	5
K3	Apply	5	5
K4	Analyze	2	2
K5	Evaluate	3	3
K6	Create	5	5
Total Marks		**25**	**25**

Assessment Pattern Level No.	Knowledge Level	ISE I	End Semester Examination
S1	Imitation	5	5
S2	Manipulation	5	5
S3	Precision	5	5
S4	Articulation	5	5
S5	Naturalization	5	5
Total Marks		**25**	**25**

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	1	2	2		3					

3 – High 2 – Medium 1 - Low

Special Instructions if any: Nil

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MEPC2007 : LAB - MECHANISMS OF MACHINES		
Teaching Scheme	**Examination Scheme**	
Practical: 2Hrs/Week	**ISE I**	**25 Marks**
Credits:01	**End Semester Evaluation**	**25 Marks**

Course Outcomes: After completion of this course students will be able to:

	Course Outcomes
CO1	Develop conceptual knowledge of Kinematics of Mechanisms and study appropriate application about mechanisms
CO2	Draw velocity and acceleration diagrams of various mechanism through graphical and analytical methods
CO3	Draw cam profiles for Graphical synthesis of cams
CO4	Generate gear tooth profiles

List of the Experiments

The student shall perform minimum eight experiments of the following, for Drawing sheets (soft tools can be used)

Sr. No.	Title of the Experiments	Skill / Knowledge Level	CO
1	Demonstration of Kinematics of Mechanisms and Machines	S1	CO1
2	Demonstration of Lower Pair Mechanism,such as Straight-line generators, Pantograph, Steering Mechanism, Hooks joint	S2	CO1
3	Draw sheets based on Velocity of Simple Mechanisms by instantaneous center method (Three or four Problems)	S3	CO2
4	Draw sheets based on Velocity analysis by relative velocity method problems(Three or four Problems)	S4	CO2
5	Draw sheets based on Acceleration analysis (Three or four Problems)	S5	CO2
6	Draw sheets based on Kinematic analysis – Short cut methods (Three or four Problems)	S1	CO2
7	Assignment based on Theory synthesis of cams, theory, classification, application, terminology etc	S4	CO3

8	Draw sheet to generate Involute tooth profile with the help of a rack on gear blank	S5	CO4	05
9	Demonstration of interference and undercutting for gear	S5	CO4	05

Assessment:

ISE I

The ISE I will consist of submitting a file for all the experiments with neatly written records of the study and diagrams.
The term work will be assessed by the course coordinator

End Semester Evaluation

The End Semester Evaluation will comprise of viva voce on the conducted practical's.
The End Semester Evaluation will be done by two examiners, one will be the course coordinator and other will be examiner appointed by DSB

Assessment Pattern: Use the relevant table for assessment pattern.

Assessment Pattern Level No.	Knowledge Level	ISE I	End Semester Examination
K1	Remember	05	2.5
K2	Understand	5	2.5
K3	Apply	05	5
K4	Analyze	10	5
K5	Evaluate		5
K6	Create		5
Total Marks			50

Assessment Pattern Level No.	Knowledge Level	ISE I	End Semester Examination
S1	Imitation	05	2.5
S2	Manipulation	05	2.5
S3	Precision	05	5
S4	Articulation	05	5
S5	Naturalization	05	5
Total Marks			50

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Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course outcome	PO 1	P O 2	PO O3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	1	3							1					
CO2	3	1	2							1			3		
CO3	2	2	2							1			3		
CO4	1	3	3							1					

Special Instructions if any:

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MEES2008: Lab-MATERIAL SCIENCE & METALLURGY		
Teaching Scheme	**Examination Scheme**	
Practical: 2Hrs/Week	**ISE I**	**25 Marks**
Credits: 01	**End Semester Evaluation**	**25 Marks**

Course Outcomes:

After completion of this course students will be able to:

	Course Outcomes
CO1	Understand different crystal systems and various calculation included in the study of crystal system.
CO2	Use of metallurgical microscope to observe the microstructures
CO3	Understand the significance of observation of microstructure of plain carbon steels / Alloy steels.
CO4	Interpret and observe microstructure of Cast Iron/ Non Ferrous Alloys.
CO5	Study the change in mechanical properties due to heat treatment
CO6	Study of change in structure due to surface/ case hardening of steels.

List of the Experiments

The student shall perform minimum seven experiments of the following

Sr. No.	Title of the Experiments	Skill / Knowledge Level	CO
1	Study & Observation of the different Crystal Systems.	K2	CO1
2	Study & Operation of Metallurgical Microscope.	K2	CO2
3	Study & Observation of Microstructure of the Plain Carbon Steels.	K3	CO3
4	Study & Observation of Microstructure of Alloy Steels.	K3	CO3
5	Study & Observation of Microstructure of Cast Iron.	K2	CO4
6	Study & Observation of Microstructure of the Non Ferrous alloys.	K2	CO4
7	Study of changes in the mechanical properties due to heat treatment.	K2	CO5
8	Study of the change in the structure due to surface/ case hardening of steels.	K2	CO6

Assessment:

ISE I

The ISE I will consist of submitting a file for all the experiments with neatly written records of the study and diagrams. The term work will be assessed by the course coordinator.

End Semester Evaluation

The End Semester Evaluation will comprise of viva voce on the conducted practicals.

The End Semester Evaluation will be done by two examiners, one will be the course coordinator and other will be examiner appointed by DSB

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	End Semester Examination
K1	Remember	5	5
K2	Understand	10	10
K3	Apply	10	10
K4	Analyze		
K5	Evaluate		
K6	Create		
Total Marks		25	25

Assessment Pattern Level No.	Knowledge Level	ISE I	End Semester Examination
S1	Imitation	10	10
S2	Manipulation	10	8
S3	Precision	5	7
S4	Articulation		
S5	Naturalization		
Total Marks		25	25

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3					3	3		1	1	3	3	1	2
CO2	1	1				2	3		1	1	3	3	1	2
CO3	1	1				2	3		1	1	3	3	1	2
CO4	3	2				3	3	3	1	1	2	1	1	2
CO5	3					3	3		1	1	3	3	1	2
CO6	1	1				2	3		1	1	3	3	1	2

3-High 2- Medium 1-Low

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MEOE0010 : TOTAL QUALITY MANAGEMENT		
Teaching Scheme	**Examination Scheme**	
Lectures: 03 hrs/ week	**ISE I**	**15 Marks**
Tutorial: 00 hrs/ week	**ISE II**	**15 Marks**
Credits: 03	**ISE III**	**10 Marks**
	End Semester Examination	**60 Marks**

Course description: After completing this course, students will have a broad and fundamental understanding of Quality. Students will have knowledge of different definitions of quality. Students will understand different quality control tools. Students will be able to understand concepts quality circles, kaizen, 5s etc. Students will understand and acquire knowledge of different ISO standardization series Students will be able to understand concepts of Just In Time (JIT) and Business Process Reengineering (BPR).

Course Objectives:

- To understand the importance of quality in modern business scenarios to individuals, organizations, customers, suppliers, and society.
- To understand E +4xcellence and Best Value
- To understand the Implication of Quality on Business.
- To understand the process of managing quality and managing services.
- To illustrate the use of total quality control tools

Course Outcome

After completing the course, students will be able to:

CO1	Define quality and discuss obstacles of quality management.
CO2	Use TQM improvement tools to enhance customer satisfaction and improve processes within their organization
CO3	Use quality management methods analyzing and solving problems of organization
CO4	Recognize the role of attitudes, beliefs, behaviors, and ethics in what we know and what we do.

Detailed Syllabus:

Unit 1	**TQM Premises** Concept of Quality, Different definitions of Quality by various thinkers, Concept of Brand, Different Parameters for ascertaining quality, Dimensions of product and service in quality, Customer orientation, continuous improvement, Cost of Quality, Productivity and flexibility, approaches and philosophies of TQM,

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Unit 2	**Tools of TQM** Basic Analytical tools-check sheets, Histograms, Pareto charts, Cause and Effect diagrams, flow charts, scatter diagrams, run charts, Cost of Quality; Quality cost measurement, Reliability and failure analysis
Unit 3	**Quality Circles** Introduction, implementation, formation, intangible impact of quality circle, inhibiting factors, Kaizen: Introduction, the Japanese style of management & Kaizenimplementation, modeling kaizen process and benefit
Unit 4	**Just in Time concept and TQM** Introduction and Concept of JIT, Relevance & advantages, approach to quality, importance of KANBAN in JIT, Introduction to ISO series of Quality Standard, Certification Requirements, Evolving Standards
Unit 5	**Latest Trends** Concept of six sigma, and Japanese 5S principle, Implementation in manufacturing and service sector, Leadership issues, Quality, vision mission and policy statements

Text and Reference Books

2. Deming W. Edward, '*Out of crisis*', MIT publishing, 1982.
3. Ishikawa & Lu, '*What is Total Quality Control? The Japanese way*', PrenticeHall, 1988
4. Tally D. J., '*Total Quality Management*', ASQC Quality Press A. V. Feigenbaum, 'Total Quality Control', McGraw Hill International, 6th Editions, USA, 2009.
5. Juran J.M., '*Quality Control Handbook*', McGrawHillBookCompany5thedition, USA, 2009.
6. Masaaki Imai, '*Kaizen: The keyto Japan's Competitive Success*', McGraw Hill International Editions, and USA, 1986.
7. Al Endres, Wiley, "*Implementing Juran's Road Map for Quality Leadership: Benchmarks and Results*", 2000.

Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	P012
CO1				1								
CO2	1				2		2					
CO3		2				1						
CO4					1							
CO 5		1										

Low-1, Medium -2, High-3

Assessment:

ISE I: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/Presentations/ Course Projects on First and Second unit.

ISE II: Shall be based on class test on third and fourth units.

ISE III: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/Presentations/ Course Projects on Fifth unit.

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	5	5		20
K2	Understand	5	5	5	20
K3	Apply	5	5	5	20
K4	Analyze				
K5	Evaluate				
K6	Create				
Total Marks 100		15	15	10	60

Special Instructions if any: Nil

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EEMC2010: Environmental Studies			
Teaching Scheme		**Examination Scheme**	
Lectures	: 3 Hrs/Week	ISE I	: 15 Marks
Tutorial	: --	ISE II	: 15 Marks
Total Credits	: 0	ISE III	: 10 Marks
		End -Semester Exam	: 60 Marks

Pre-requisites: Nil

Course objectives:

1. To become aware about the various types of pollution, its sources, effects and control measures
2. To become aware about present environmental issues
3. To become aware of the importance of natural resources and environmental legislation
4. To become aware about environmental biotechnology and bio monitoring
5. To become aware of the biodiversity, conservation methods and factors for the loss of biodiversity

Unit wise Course Outcomes expected:

After completion of this course students will be able to-

CO1. Learn about the basics of environment
CO2. Understand the harmful effects of human activities on environment and their solutions
CO3. Understand the use of biotechnology and bio monitoring for the treatment of environment
CO4. Understand the concept of climate change, global warming, acid rain, various disasters and its mitigation measures

Detailed syllabus:

UNIT-I	**A) Concepts of Environmental Sciences** Environment, Levels of organizations in environment, Structure and functions in an ecosystem; Biosphere, its Origin and distribution of land, in water and in air, Broad nature of chemical composition of plants and animals **B) Natural Resources** Renewable and Non-renewable Resources, Forests, water, minerals, Food and land (with example of one case study); Energy, Growing energy needs, energy sources (conventional and alternative)
UNIT-II	**A) Biodiversity and its conservation** Biodiversity at global, national and local levels; India as a mega-diversity nation; Threats to biodiversity (biotic, abiotic stresses),and strategies for conservation **B)Environmental Pollution** Types of pollution- Air, water (including urban, rural, marine), soil, noise, thermal, nuclear; Pollution prevention; Management of pollution- Rural/Urban/Industrial waste management [with case study of any one type, e.g., power (thermal/nuclear), fertilizer, tannin, leather, chemical, sugar], Solid/Liquid waste management, disaster management **C) Environmental Biotechnology** Biotechnology for environmental protection- Biological indicators, bio-sensors; Remedial measures- Bio-remediation, phyto remediation, biopesticides, bio-fertilizers; Bio-reactors- Design and application
UNIT-III	**A) Social Issues and Environment** Problems relating to urban environment- Population pressure, water scarcity, industrialization; remedial measures; Climate change-Reasons, effects (global warming, ozone layer depletion, acid rain) with one case study; Legal issues- Environmental legislation (Acts and issues involved), Environmental ethics **Environmental Monitoring** Monitoring- Identification of environmental problem, tools for monitoring (remote sensing, GIS); Sampling strategies- Air, water, soil sampling techniques
UNIT-IV	**Laboratory Work including Practical and Field Work** covering, of biogeographical zones and expanse of territorial waters on the map of India;

	Identification of biological resources (plants, animals, birds) ata specific location; Determination of (i) pH value, (ii) water holding capacity and (iii) electrical conductivity of different types of soils; Determination of energy content of plants by bomb calorimeter; Measurement and classification of noise pollution; Determination of particulate matter from an industrial area by high volume sampler; Determination of ico-chemical parameters (pH, alkalinity, acidity, salinity, COD, BOD) of tap water, well water, rural water supply industrial effluent and sea water &potability issues; Demonstration of Remote Sensing and GIS methods; Industrial visit for environmental biotechnology processes (e.g., any one of the fermentation, tissue culture, pharmaceutical industries)

Textbooks & Reference books

1. A Text Book of Environmental Studies by Bharucha E, University Press (India) Pvt. Ltd, 2005
2. A Text Book of Environmental Studies by Nadaf F. M., Pawaskar V. R., Intellectual Book Bureau, Bhopal,2006
3. Fundamental of Ecology by Odum E. P, Natraj Publishers, Dehradun, 1996
4. Inroduction to Environmental Engineering and science by Gilbert M and Wendell P., Pearson Education India, 2015
5. Environmental Science by S.C Santra, New Central Book Agency, 2011
6. Environmental Education by Sharma R. A, 1998

Mapping of Course outcome with program outcomes (Mechanical Engineering):

rse outcome	1	2	3	4	5	6	7	8	9	10	PO11	PO12	PO13	PO14	PO15
1															
2															
3															
4															
5															

1-

Low 2- Medium 3- High
Sample Assessment Table:

sessment Tool	+K3	+K3	+K3	+K3
it wise Course outcomes	1	2	3	4
ss Test 30 Marks	10	10	10	
achers Assessment 10 Marks		05	05	
E Assessment 60 Marks	18	18	12	12

Sample Assessment Pattern:

Assessment Pattern Level no.	Knowledge Level	Test	Teachers Assessment/assignment	End Semester Examination
K1	Remember	10		12
K2	Understand	10		24
K3	Apply	10	10	12
K4	Analyze			12
	TOTAL	30	10	60

Teaching Strategies:
The teaching strategy is planed through the lectures, tutorials and team-based homework. Exercises are assigned weekly to stimulate the students to actively use and revise the learned concepts which also help the students to express their way of solving the problems fluently in written form. Most critical concepts and mistakes are emphasized.

Assessment:

ISE I: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/Presentations/ Course Projects on First and Second unit.

ISE II: Shall be based on class test on third and fourth units.
ISE III: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/Presentations/ Course Projects on Fifth unit.

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MEPC2010 : APPLIED THERMODYNAMICS		
Teaching Scheme	**Examination Scheme**	
Lectures: 03 hrs/ week	**ISE I**	**15 Marks**
Tutorial: 00 hrs/ week	**ISE II**	**15 Marks**
Credits: 03	**ISE III**	**10 Marks**
	End Semester Examination	**60 Marks**

Prerequisites: MEPC2006 Engineering Thermodynamics Course

description:

This course consists of understanding the working and analyzing the performance of reciprocating compressors. Basic understanding of internal combustion engines, various systems in IC engines is included in this course. Analysis of vapour power cycles is covered in this course. Also, this course includes theoretical understanding of vapour compression refrigeration, non-conventional refrigeration systems, need and working of various types of condensers and cooling towers.

Course Outcomes:

After completing the course, students will be able to:

	Course Outcomes
CO1	analyze the performance of air compressor
CO2	Analyze the performance of Nozzles
CO3	Identify various parts of refrigeration system and describe their functions.
CO4	Analyze the performance of vapour power cycles
CO5	Select condenser and cooling tower for particular application

Detailed Syllabus:

Unit1	**Gas Compressors** A) Classifications and working principles, Reciprocating compressors. Terminologies used, effect of clearance volume, actual indicator diagram, multistage compression, two stage compressors (Numerical problems on reciprocatingcompressors) B) Rotary compressors, working principles, Roots blower, Vane type blower, Centrifugal compressor, axial flow compressor, Comparison between reciprocating and rotary compressors, air motor (Descriptive treatment only).
Unit 2	**Flow Through Nozzles:** Velocity and heat drop, mass discharge through a nozzle, critical pressure ratio and its significance, effect of friction and nozzle efficiency, supersaturated flow.
Unit3	**Introduction to Refrigeration and Air Conditioning:** Fundamentals of refrigeration systems, COP, unit of refrigeration, Introduction to Air conditioning, psychometric chart. **Introduction to Steam Turbines:** Principle of operation, classification, Velocity diagrams, Degree of reaction, methods of governing

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Unit 4	**Vapour Power Cycles** Carnot cycle using steam, ideal Rankine cycle, modified Rankine cycle, Reheat and Regenerative cycles with bleeding of steam, thermal efficiency, specific steam consumption, work ratio, power output, effect of superheat, inlet pressure and back pressure on performance of Rankine cycle (Numerical Treatment)
Unit 5	**Steam Condensers** Classifications, comparison between Jet and Surface condensers, vacuum efficiency, vacuum measurement, mass of circulating water required in a condenser, air removal, capacity of air extraction pumps, introduction to cooling towers.

Text and Reference Books

1. Domkundwar & Domkundwar, "*Introduction to Thermal Power Engineering*",Dhanpatraiand Sons, New Delhi, 2014.
2. Ballaney P.L., "*Thermal Engineering*", Khanna Publications, New Delhi, 2014.
3. Domkundwar S, Kothandaraman C. P. & Domkundwar A., "*A Course in Thermal Engineering*", Dhanpat Rai and Co. publication, New Delhi, 2004.
4. Eastop T D, McConkey A, "*Applied Thermodynamics*", Pearson education, New Delhi, 2002.
5. Rajadurai J S, "*Thermodynamics and Thermal Engineering*", New Age Publishers, N. Delhi, 2010.

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes 3 – High 2 – Medium 1 - Low

Course outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2				2	2			2	1	1	3	
CO2	3	2				2	2			2	1	1	3	
CO3	3	1				2	2			2	1	1	2	
CO4	3	2				2	2			2	1	1	3	
CO5	3	1				2	2			2	1	1	2	

Assessment:

ISE I: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/Presentations/ Course Projects on First and Second unit.

ISE II: Shall be based on class test on third and fourth units.

ISE III: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/Presentations/ Course Projects on Fifth unit.

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	5	5		20

K2	Understand	5	5	5	20
K3	Apply	5	5	5	20
K4	Analyze				
K5	Evaluate				
K6	Create				
Total Marks 100		15	15	10	60

Assessment table:

Assessment Tool	**K1, K2, K3**	**K1, K2, K3**	**K2 and K3**	**K2 and K3**	**K2 and K3**
	CO1	CO2	CO3	CO4	CO5
ISE I (15 Marks)	8	7			
ISE II (15 Marks)			8	7	
ISE III (10 Marks)	0	0	2	3	5
ESE Assessment (60 Marks)	12	12	12	12	12
Total Marks 100	20	19	22	22	17

Special Instructions if any: Nil

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MEPC2011 : Machine Drawing		
Teaching Scheme	**Examination Scheme**	
Lectures: 03 hrs/ week	**ISE I**	**15 Marks**
Tutorial: 00 hrs/ week	**ISE II**	**15 Marks**
Credits: 03	**ISE III**	**10 Marks**
	End Semester Examination	**60 Marks**

Prerequisites: MEES1001 Engineering Graphics and Design

Course description: After completing this course, students will have a broad and fundamental concept of intersection curves in sheet metal work, Apply concept of curves in manufacturing; apply the knowledge of developed surfaces in sheet metal product manufacturing, Assembly and Details

Course Outcomes:
After completing the course, students will able to:

	Course Outcomes
CO1	Draw curves of intersection of solids.
CO2	Applying the knowledge of sheet metal of manufacturing, draw the corresponding developed surfaces
CO3	Understand the Conventional methods of representing threaded fasteners
CO4	Understand the Conventional representation of Riveted joints

Detailed Syllabus:

Unit 1	**Intersection of Surfaces** Line or Curve of intersection of two solids, Methods: Line method, Cutting-plane method. Intersection of vertical prism with prism, cylinder, cone (Horizontal or Inclined), Intersection of vertical Cylinder with cylinder, cone, Intersection of vertical cone with cone, prism.
Unit 2	**Development of Surfaces** Introduction: Methods of Development, Development of lateral surfaces of right solids- Cube, Prism, Cylinders, Pyramids, Cone, Development of Transition Pieces, Spheres
Unit 3	**Conventional Representation** Standard convention using SP – 46 (1988)-Materials C.I., M.S, Brass, Bronze, Aluminum, wood, Glass, Concrete and Rubber-Long and short break in pipe, rod and shaft.- Various sections- Half, removed,-Standard convention of Knurling, splined shafts, and chain wheels Springs with square and flat ends, Gears, sprocket wheel-Countersunk &counter bore, Surface roughness-Indication of machining-symbol showing direction of lay, roughness grades, machining allowances, Machining symbols used in industry
Unit 4	**Threaded Fasteners** Screw thread terminology-Conventional representation of External threads and internal threads Draw the top and front view of hexagonal headed bolt with nut across flat and corner-Draw - square headed bolt across corner and flat-cylindrical headed bolt-Eye bolt. **Riveted Joints** Types of riveted joints-Draw the sectional front view and top view of-single riveted lap joint, double riveted lap joint with chain riveting and zigzag riveting.

Reference Books

1. Bhatt N. D., Panchal V. M., "Engineering Drawing", Charotar Publishing House, 2010.
2. Dhabhade M. L., "Engineering Graphics", Vol. - I and Vol.-II, Vision Publications,Pune, 2003.
3. Gill P. S., "Engineering Drawing", S. K. Katariya & Sons, Delhi, 2013.
4. Bhatt N. D., Panchal V. M., "Machine Drawing", Charotar Publishing House, 2014.
5. Siddheswar, Kannaiyah, and Shastry VVS, "Machine Drawing", TMH
6. Dhawan, "A Text Book of Machine Drawing," S. Chand publications 2014

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes
1 – High 2 – Medium 3 - Low

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1		1	1		1								2	
CO2		2	2										1	
CO3		2	3		1									
CO4		2	2	1	1		2						2	

Assessment:

ISE I: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/Presentations/ Course Projects on First and Second unit.

ISE II: Shall be based on class test on third and fourth units.

ISE III: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/Presentations/ Course Projects on Fifth unit.

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	5	5		20
K2	Understand	5	5	5	20
K3	Apply	5	5	5	20
K4	Analyze				
K5	Evaluate				
K6	Create				
Total Marks 100		15	15	10	60

Assessment table:

Assessment Tool	K2 and K3	K2 and K3	K2 and K3	K2 and K3
	CO1	CO2	CO3	CO4
ISE I (15 Marks)	8	7		
ISE II (15 Marks)			8	7
ISE III (10 Marks)	2	3	2	3
ESE Assessment (60 Marks)	15	15	15	15
Total Marks 100	25	25	25	25

Special Instructions if any: Nil

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MEPC2012 : STRENGTH OF MATERIALS		
Teaching Scheme	**Examination Scheme**	
Lectures: 02 hrs/ Week	**ISE I**	**10 Marks**
Tutorial: 00 hrs/ Week	**ISE II**	**10 Marks**
Credits: 02	**ISE III**	**05 Marks**
	End Semester Examination	**25 Marks**

Prerequisites: MA1001: Engineering Mathematics I, MA1002: EngineeringMathematics II, AM1001 Engineering Mechanics

Course description: The strength of a material is its ability to resist external forces without breaking. Strength of Materials is the foundation for Engineering design courses. The course covers material behavior, stresses, strains and deformations with simple applications in engineering designs. Topics to be chosen from elastic and elastic-plastic behavior; plane stress and strain; constitutive relationships, principal stress and strain, failure criteria, bending and shearing stresses in beams, Mohr's circle, Euler's theory and Rankin's theory ofcolumn failure with different support conditions, torsion of solid and hollow circular sections, work and strain energy concepts.

Course Outcomes:

After completing the course, students will be able to:

CO1	Apply concepts of stress and strain to solve problems.
CO2	Compute Shear Force and Bending Moment for determinate beams and draw Shear Force and Bending Moment Diagrams for various loading conditions.
CO3	Apply the knowledge of bending and shear concept to determine various stresses and draw stress diagrams.
CO4	Explain theory of column failure with different support conditions and developnumerical ability to solve numerical problems.
CO5	Apply knowledge of strain energy and torsion to solve numerical problems.

Detailed Syllabus:

Unit 1	**Simple Stresses and Strains** Elasticity, Stress, Strain, Hook's Law, Young's Modulus, numerical on stresses inbar of varying sections and composite bars, numerical on statically indeterminate problems, elastic constants, bulk modulus, shear modulus and their relations and numerical.
Unit 2	**Shear Force and Bending Moment** Definition of shear force and bending moment, relation between SF, BM and intensity of loading, numerical on statically determinate beams (simply supported,cantilever, overhanging).

Unit 3	**Stress in beams and Principal stresses and Strains** **a) Stress in beams:** Theory of simple bending, assumptions, neutral axis, moment of resistance, section modulus, bending stress distribution diagram, numerical on statically determinate beams of rectangular and I section beams,section consisting of different materials, Shear stresses in beams **b) Principal stresses and Strains:** Tangential and normal stresses, Principal Planes, principal stresses, analytical and graphical methods to find stresses on anoblique section, Mohr's Circle.
Unit 4	**Columns & Struts** Euler's theory and Rankin's theory of column failure with different support conditions, derivations, radius of gyration, slenderness ratio, factor of safety,numerical on single and built-up cross sections.
Unit 5	**Strain Energy, Theory of torsion** **a) Strain Energy:** Definition, resilience, Proof resilience, Modulus of resilience,strain energy stored in the body due to gradually applied loads, suddenly applied loads and impact loads, strain energy due to shear, bending **b) Theory of torsion:** Theory of torsion, assumptions, torsional stresses and strains numerical on solids hollow circular shafts, composite shafts and varyingsections.

Text and Reference Books

1. S.S. Rattan – "*Strength of Material* "– Tata McGraw Hill Publication Co. Ltd. S, 2017.
2. Ramamurtham – "*Strength of material"* - Dhanpat Rai Publication, 2020.
3. Singer and Pytel – "*Strength of materials"* - Harper and row Publication, 1990.
4. Beer and Johnston – "*Strength of materials"* - CBS Publication, 2014.
5. Timoshenko and Young – "*Strength of Materials"* - CBS Publication, 2002.

Assessment:

ISE I: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/Presentations/ Course Projects on First and Second unit.

ISE II: Shall be based on class test on third and fourth units.

ISE III: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/Presentations/ Course Projects on Fifth unit.

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course Out come	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		3	3	3		3								3
CO2		3	2	2		2								
CO3		2	3	3		3						3		

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CO4		3	2	3		2					3			
CO5		2	3	2		3							3	

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3 – High 2 – Medium 1 – Low

Assessment Pattern:

Assessment PatternLevel No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	2.5	2.5	2.5	5
K2	Understand	2.5	2.5	2.5	5
K3	Apply	2.5	2.5	00	5
K4	Analyze	00	00	00	00
K5	Evaluate	2.5	2.5	00	10
K6	Create	00	00	00	00
Total Marks 50		10	10	5	25

Assessment table:

Assessment Tool	**K3**				
	CO1	CO2	CO3	CO4	CO5
ISE I (10 Marks)	6	4			
ISE II (10 Marks)			5	5	
ISE III (5 Marks)	1	1	1	1	1
ESE Assessment (25 Marks)	5	5	5	5	5
Total Marks 50	12	10	11	11	6

Special Instructions if any:

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MEPC2013 : METROLOGY AND QUALITY CONTROL		
Teaching Scheme	**Examination Scheme**	
Lectures: 03 hrs/ week	**ISE I**	**15 Marks**
Tutorial: 00 hrs/ week	**ISE II**	**15 Marks**
Credits:03	**ISE III**	**10 Marks**
	End Semester Examination	**60 Marks**

Prerequisites: MEES1001: Basics of Mechanical Engineering, PHBS1001: Engineering Physics,

Course description:

The course is aimed at giving the fundamentals of quality assurance methods for manufacturing processes and dimensional measuring systems. In particular, the course focuses on: introduction to quality management systems, measurement systems, requirements for measurement processes and measuring equipment, geometrical products specifications & verification, dimensional & geometrical metrology, coordinate measuring machine.

Course Outcomes:

After completing the course, students will be able to:

	Course Outcomes
CO1	Identify different types of standards and explain tolerance, limits of size, fits, geometric and position tolerances and gauge design.
CO2	Illustrate selection and use of comparators, angular measurement and gear measurement.
CO3	Summarize the methods of measurement of surface roughness and screw thread. Testing flatness, concave and concave surfaces by light wave interference. Understand working of Co-ordinate Measuring Machines, Laser Viewers for profile checks.
CO4	Recall the concept of Quality Control and ISO 9000 certification.
CO5	Construct the control charts and recommend acceptance sampling appropriately.

Detailed Syllabus:

Unit 1	**Metrology:** Definition and concept of metrology and standardizations, Standards of linear measurement, Line standard, End standard and wavelength standard, Traceability, Reliability. **Limits, Fits and Gauges:** **Limits**: Tolerances, different ways of expressing accumulation, relationship between tolerances and cost, interchangeability, selective assembly maximum and minimummetal conditions, Indian standard (IS 919-1963)

	Fits: Terminology for limits and fits, types of fits, hole basis system, shaft basis system, selection of fits, types of assemblies like trial and error, interchangeable assembly, **Gauges**: Plain gauges, ring gauges, snap gauges, adjustable gap gauges, control and profile gauges, material for gauges, Gauge design: Taylor's principle, gauge maker's tolerance, wear allowances, numerical on gauge design. Industrial applications of limits, fits and gauges.
Unit 2	**Comparators:** Introduction, types of comparators, construction and working of different types of comparators like mechanical, optical, electric, pneumatic. Industrial applications of comparators. **Angular measurements:** Venire bevel protector, universal bevel protector, sine bar, angle gauges, optical instrument like auto collimator, angle dekkor, optical profile projector. Industrial applications of angular measuring instruments. **Measurement and testing of gears:** Sources of errors in manufacturing gears, gear measurement, gear rolling tests.
Unit 3	**Measurement of surface finish:** Definition, terminology, methods of measuring surface finish by using surface roughness tester, **Metrology of screw threads**: Screw threads terminology, error in threads and their effects, measurements of various elements of threads. **Measurement by using light-wave interference:** Interference of two rays, light source for interferometry, interferometry applied to flatness, concave and convex testing. **Measuring machines:** Co-ordinate Measuring Machines (CMM), Laser Viewers for profile checks.
Unit 4	**Quality Control:** Quality: meaning of quality of product & services, Quality characteristics, Quality of design, Quality of conformance, Quality of performance, Concept of reliability, Cost, Quantity assurance, Cost of rework & repair, Quality Control & Inspection, Inspection stages. ISO 9000 Series & other standards: Concept, ISO 9000 series quality standards, QS14000, Standards in general, necessity of ISO 9000 certification and procedure.
Unit 5	**Statistical Quality Control** – Meaning and importance of SQC, Variable and attribute Measurement, control charts – inherent and assignable sources of variation, control charts for variables $\bar{X}$ & R charts, control charts for attributes P and C charts, process capability of machine, determination of statistical limits, different possibilities, Rejection area, statistically capable and incapable processes, Cp, Cpk. **Acceptance Sampling** – Concept, Comparison with 100% inspection, Different types of sampling plans, with merits and demerits, OC curve, It's importance and significance, Producer's risk, Consumer's risk, AQL, AOQL, IQL, LTPD

Text and Reference Books

1. Jain R. K., "*Engineering Metrology*", Khanna Publishers, Delhi, 2004.
2. Gupta I. C., "*A Textbook of Engineering Metrology*", Dhanpat Rai and Sons, 2019.
3. ASTE, *Handbook of Industrial Metrology*, PHI Publications, 2013.
4. Grant and Leavenworth," *Statistical Quality Control*", McGraw Hill publication, 2017.
5. *Quality Control*, NITTTR Madras, Tata McGraw Hill Publishing Ltd, 2014.
6. Hume K J, "*Engineering Metrology*", Macdonald & Company Limited, London, 1963.

Assessment :

ISE I: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/Presentations/ Course Projects on First and Second unit.

ISE II: Shall be based on class test on third and fourth units.

ISE III: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/Presentations/ Course Projects on Fifth unit.

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

3 – High2 – Medium 1 – Low

Course outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	2			3	3				3			2	
CO2	1				2	3				3			2	
CO3	1				1	3				3			2	
CO4	1					3				3			2	
CO5	1	1			2	3				3			2	

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	5	5		20
K2	Understand	5	5	5	20
K3	Apply	5	5	5	10
K4	Analyze				
K5	Evaluate				10
K6	Create				
Total Marks 100		15	15	10	60

Assessment table:

Assessment Tool	K3				
	CO1	CO2	CO3	CO4	CO5
ISE I (15 Marks)	7	8			
ISE II (15 Marks)			7	8	
TA (10 Marks)	2	2	2	2	2

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ESE Assessment (60 Marks)	12	12	12	12	12
Total Marks 100	21	22	21	22	14

Special Instructions if any: Nil

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MEPE2014 : MACHINE TOOLS		
Teaching Scheme	**Examination Scheme**	
Lectures: 03 hrs./ week	**ISE I**	**15 Marks**
Tutorial: -	**ISE II**	**15 Marks**
Credits: 03	**ISE III**	**10 Marks**
	ESE	**60 Marks**

Prerequisites: NIL

Course description: After completing this course, students will have a broad and fundamental understanding of the concepts of terminology and geometry of tools and various operations on lathe, various milling operations, drilling, boring and broaching operations, grinding machines and process, non-traditional machining processes.

Course Outcomes:

After completing the course, students will be able to:

	Course Outcomes
CO1	Select the correct tool for the particular machining operation on lathe.
CO2	Acquire the knowledge of indexing on milling machine for gear cutting.
CO3	Acquire practical knowledge of drilling, boring, broaching and grinding operations.
CO4	Compare and select suitable Non-Traditional Machining process for particular application.

Detailed Syllabus:

Unit 1	**Lathe machines** Functions of a lathe, types, size of a lathe, functions of various parts of a lathe, feed mechanism, thread cutting mechanism, lathe accessories and attachments, lathe operations, capstan and turret lathes, automatic lathes.
Unit 2	**Milling machines and Gear Cutting** Types of milling machines and their industrial applications, milling cutters and their uses, indexing and dividing heads, indexing methods, calculations of indexing, multi-axis milling, Gear cutting methods such gear generating and gear hobbing.
Unit 3	**Drilling, Boring and Broaching machines** Drilling- Introduction, types of drill, twist drill nomenclature, types of drilling machines and their applications, work holding devices, tool holding devices, drilling machine operation, speed, feed and machine time. Boring-Introduction, classification of boring machines, boring bars, boring heads, boring defects, Broaching- Introduction, principal parts of broach, broaching machines, application of broach, advantages of broaches, limitations of broaches and broaching tools.
Unit 4	**Grinding machines** Introduction, grinding wheels, manufacturing of artificial abrasives, bonds and bonding processes, grit, grade and structure of grinding wheels, types of wheels, method of specifying grinding wheel, selection of grinding wheels, dressing and truing of grinding wheels, types of grinding machines

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Unit 5	**Shaper, Planning and Slotting Machines** Shaper Machines-Types of shapers, principal parts, size, mechanisms, operations, industrial applications. Planning Machines-Types of planning machines, principal parts, size, mechanisms, operations, industrial applications. Slotting Machines- Types of slotting machines, principal parts, size, mechanisms, operations, industrial applications.

Text and Reference Books

1. H. Gerling, "*All about Machine Tools*", Wiley Eastern, 2nd edition, 2006.
2. Krar S. F., "*Technology of Machine Tools*", Mc Graw Hill, 7th edition, 2011.
3. G. Boothroyd, "*Fundamentals of Metal Machining and Machine Tools*", CRC press,3rd edition, 2005.
4. Raghuvanshi B.S., "*Workshop Technology*", Vol. I, Dhanpat Rai & Co., New Delhi, 1991.
5. Hazra Choudhary, "*Elements of Workshop Technology*", Vol. I, Dhanpat Rai Pub.,New Delhi, 1994
6. Jain R.K., "*Production Technology*", Khanna Publications,17th edition NewDelhi, 2014.
7. Bawa H.S., "*Workshop Technology*", Vol. I, Mc Graw Education, New Delhi, 1998.

Assessment:

ISE I: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/Presentations/ Course Projects on First and Second unit.

ISE II: Shall be based on class test on third and fourth units.

ISE III: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/Presentations/ Course Projects on Fifth unit.

Mapping of Course outcome with Program Outcomesand Program Specific Outcomes

3- High, 2 – Medium, 1 - Low

Course outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	2												
CO2		3		2								1			
CO3	3		3		2										
CO4		3				2						1			

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	5	5		20
K2	Understand	5	5	5	20
K3	Apply	5	5	5	10
K4	Analyze				
K5	Evaluate				10
K6	Create				
Total Marks 100		15	15	10	60

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Assessment table:

Assessment Tool	**K3**				
	CO1	CO2	CO3	CO4	CO5
ISE I (15 Marks)	7	8			
ISE II (15 Marks)			7	8	
TA (10 Marks)	2	2	2	2	2
ESE Assessment (60 Marks)	12	12	12	12	12
Total Marks 100	21	22	21	22	14

Special Instructions if any: Nil

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MEPE2015 : PRODUCTION PROCESSES		
Teaching Scheme	**Examination Scheme**	
Lectures: 03 hrs./ week	**ISE I**	**15 Marks**
Tutorial: -	**ISE II**	**15 Marks**
Credits:3	**ISE III**	**10 Marks**
	ESE	**60 Marks**

Prerequisites: NIL

Course description:
This course provides the basic knowledge of Production processes. Course includes fundamentals of metal cutting, Design of jigs and fixtures, Sheet metal working, Gear manufacturing and CNC machine, Unconventional machining processes.

Course Outcomes:

After completing the course, students will be able to:

	Course Outcomes
CO1	Select the correct tool for the particular machining operation.
CO2	The knowledge of indexing process on milling machine for gear cutting
CO3	Design the jigs and fixtures and press tools.
CO4	Acquire the knowledge of grinding operations and Broaching operation
CO5	Understand practical aspects of nontraditional machining

Detailed Syllabus:

Unit 1	**Theory of Metal cutting** Mechanics of Metal cutting, Cutting parameters, chip formation & types, Machining forces and merchants force circle diagram. Tool materials, Tool Geometry, Tool life, Tool wear types, cutting forces and power consumption, economics of metal cutting, Cutting fluid classification.
Unit 2	**Metal Joining Processes** Welding processes- Introduction, weldability, Gas welding, Arc welding with D.C. and A.C., Gas Tungsten Arc welding (GTAW), Gas Metal Arc welding (MMAW), Plasma Arc, Submerged Gas welding, Resistance welding, Thermit welding, Electron beam welding, Laser welding, Friction welding, Ultrasonic welding and applications various welding methods, welding defects.
Unit 3	**Gear manufacturing and super finishing processes** Gear Manufacturing: Gear cutting process - Forming and generations, Gear cutting,Milling, Hobbing, Gear Shaping, Shaving, lapping, Grinding. Super finishing Process: Honning, lapping, burnishing and buffing processes with its working principle, advantages and disadvantages with their applications.

Unit 4	**Advanced Machining Processes PART -I** Introduction, classification of machining processes, Abrasive jet machining (AJM), Ultrasonic machining (USM), Chemical machining (CHM), Electrochemical machining (ECM), Electrochemical grinding (ECG) and industrial applications of these advanced machining processes
Unit 5	**Advanced Machining Processes PART-II** Electro discharge machining (EDM) with Die Sinking EDM and Wire Cut EDM, Electron beam machining (EBM), Laser beam machining (LBM), Plasma arc machining (PAM), Ion beam machining and industrial applications of these advanced machining processes.

Text and Reference Books

1. DeGarmo, Black Kosher," *Materials and Processes in Manufacturing*" Prentice Hall of India edition 2005.
2. Amitabh Ghosh, Asok Kumar Malik," *Manufacturing Science"* EWP Affiliated EastWest Private Limited, edition 2006.
3. P N Rao Vo I & II, "*Manufacturing Technology*" edition 2009, Tata McGraw Hill Publication Manufacturing Processes -I &II, Bawa H.S, Tata McGraw HillPublication edition 2004.
4. P H Joshi, "*Jigs and Fixtures*"1 st edition, Tata McGraw Hill Publication, 2001.

Assessment:

ISE I: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/Presentations/ Course Projects on First and Second unit.

ISE II: Shall be based on class test on third and fourth units.

ISE III: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/Presentations/ Course Projects on Fifth unit.

Mapping of Course outcome with Program Outcomesand Program Specific Outcomes

3-High 2 – Medium 1 - Low

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	3	3							2			
CO2	1	1	1	3	3										
CO3	2	1	1	2	1							2			
CO4	1	1	1	3	3										
CO5	2	2	2	3	1							2			

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Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	5	5		20
K2	Understand	5	5	5	20
K3	Apply	5	5	5	10
K4	Analyze				
K5	Evaluate				10
K6	Create				
Total Marks 100		15	15	10	60

Assessment table:

Assessment Tool	**K3**				
	CO1	CO2	CO3	CO4	CO5
ISE I (15 Marks)	7	8			
ISE II (15 Marks)			7	8	
TA (10 Marks)	2	2	2	2	2
ESE Assessment (60 Marks)	12	12	12	12	12
Total Marks 100	21	22	21	22	14

Special Instructions if any: Nil

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MEPC2016 : LAB - APPLIED THERMODYNAMICS		
Teaching Scheme	**Examination Scheme**	
Practical: 2Hrs/Week	**ISE I**	**25 Marks**
Credits:01	**End Semester Evaluation**	**25 Marks**

Course Outcomes:

After completion of this course students will be able to:

	Course Outcomes
CO1	Hands on experience with reciprocating compressor and its performance analysis.
CO2	Hands on experience with centrifugal blower and its efficiency calculation,
CO3	Understand about working of nozzles, refrigerator and cooling tower
CO4	Communicate effectively by preparing laboratory report and Visit Report

List of the Experiments

The student shall perform minimum eight experiments of the following

Sr. No.	Title of the Experiments	Skill / Knowledge Level	CO
1	Trial on two stage Reciprocating air Compressors	K3	CO1 and CO4
2	Determination of efficiency of blower.	K3	CO2 and CO4
3	Study of Nozzles	K2	CO3 and CO4
4	Performance Evaluation of Vapor Compression Refrigeration system	K3	CO3 and CO4
5	Study of domestic refrigerator.	K2	CO3 and CO4
6	Study of surface condenser.	K2	CO3 and CO4
7	Study of cooling towers	K2	CO3 and CO4
8	Visit to industry related to applied thermal systems.	K2	CO4

Assessment:

ISE I

The ISE I will consist of submitting a file for all the experiments with neatly written records of the study and diagrams.

The term work will be assessed by the course coordinator

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End Semester Evaluation

The End Semester Evaluation will comprise of viva voce on the conducted practical's.The End Semester Evaluation will be done by two examiners, one will be the course coordinator and other will be examiner appointed by DSB

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	End Semester Examination
K1	Remember	5	5
K2	Understand	10	10
K3	Apply	10	10
K4	Analyze		
K5	Evaluate		
K6	Create		
Total Marks		25	25

Assessment Pattern Level No.	Knowledge Level	ISE I	End Semester Examination
S1	Imitation	10	10
S2	Manipulation	8	8
S3	Precision	7	7
S4	Articulation		
S5	Naturalization		
Total Marks		25	25

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes
3-High 2 – Medium 1 - Low

Course outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3				2	1		3	3	1	1	3	2
CO2	3	3				2	1		3	3	1	1	3	2
CO3	3					1	1		3	3	1	1	3	2
CO4	1	2				1	1	1	3	3	2	3	3	2

Special Instructions if any:

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MEPC2017 : LAB- MACHINE DRAWING		
Teaching Scheme	**Examination Scheme**	
Practical: 2Hrs/Week	**ISE I**	**25 Marks**
Credits:01	**End Semester Evaluation**	**25 Marks**

Course Outcomes:

After completion of this course students will be able to:

	Course Outcomes
CO1	Enhance the knowledge of drawing machine components

List of the Experiments

The student shall perform eight experiments of the following

Sr. No.	Title of the Experiments	Skill / Knowledge Level	CO
1.	One half imperial sheet on Problems on Intersection ofSurfaces	K2 and K3	CO1
2.	One half imperial sheet on Problems on Development ofSurfaces	K2 and K3	CO1
3.	One half imperial sheet on Problems on Conventional Representation of standards and Machining Symbols.	K2 and K3	CO1
4.	One half imperial sheet on Problems on Threaded Joints	K2 and K3	CO1
5.	One half imperial sheet on Problems on Riveted Joints	K2 and K3	
6.	Introduction to the unit assembly drawing, steps involvedin preparing assembly drawing from Details-Sequence in assembly. One half imperial sheet on Problems on Assembly Drawing	K2 and K3	CO1
7.	One half imperial sheet on Problems on AssemblyDrawing	K2 and K3	CO1
8.	One Full imperial sheet on Problems on AssemblyDrawing	K2 and K3	CO1

Assessment : The ISE I will consist of submitting a Portfolio of all sheets drawn by students. The quality of drawing and usage of relevant standards by the students will be taken into consideration for assessment. The term work will be assessed by the course coordinator

End Semester Evaluation

The End Semester Evaluation will comprise of viva voce on the conducted practicals.
The End Semester Evaluation will be done by two examiners, one will be the course coordinator and other will be examiner appointed by DSB

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Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	End Semester Examination
S1	Imitation	05	10
S2	Manipulation	10	8
S3	Precision	10	7
S4	Articulation		
S5	Naturalization		
Total Marks		25	25

Assessment Pattern LevelNo.	Knowledge Level	ISE I	End Semester Examination
K1	Remember		
K2	Understand	15	10
K3	Apply	10	15
K4	Analyze		
K5	Evaluate		
K6	Create		
Total Marks		25	25

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	2	1										1	1

Special Instructions if any: Nil

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MEPC2018 :Lab - STRENGTH OF MATERIALS		
Teaching Scheme	**Examination Scheme**	
Practical: 2Hrs/Week	**ISE I**	**25 Marks**
Credits:01	**End Semester Evaluation**	**25 Marks**

Course Outcomes:

After completion of this course students will be able to:

	Course Outcomes
CO1	Interpret the test results
CO2	Test and measure the performance of material
CO3	Apply test knowledge to define and understand different material behavioral concept

List of the Experiments

The student shall perform minimum eight experiments of the following using MATLAB/ MIPOWER/PSCAD

Sr. No.	Title of the Experiments	Skill / Knowledge Level	CO
1	Study of Universal Testing Machine and its attachments and Extensometer	S1	CO1
2	Tension test on mild steel and Tor Steel specimens	S2	CO2
3	Shear test on metals (Direct and punching)	S2	CO3
4	Flexural test on timber specimens	S2	CO3
5	Impact test on metals	S3	CO3
6	Hardness test on metals (Brinell and Rockwell)	S4	CO2
7	Torsion test on mild steel and Tor steel circular specimens	S5	CO2

Assessment: ISE I

The ISE I will consist of submitting a file for all the experiments with neatly written records of the study and diagrams.

The term work will be assessed by the course coordinator

End Semester Evaluation

The End Semester Evaluation will comprise of viva voce on the conducted practicals.The End Semester Evaluation will be done by two examiners, one will be the course coordinator and other will be examiner appointed by DSB

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	End Semester Examination
K1	Remember	5	5

K2	Understand	5	5
K3	Apply	5	5
K4	Analyze	2	3
K5	Evaluate	5	5
K6	Create	3	2
Total Marks		25	25

Assessment Pattern Level No.	**Knowledge Level**	**ISE I**	**End Semester Examination**
S1	Imitation	5	3
S2	Manipulation	5	2
S3	Precision	5	10
S4	Articulation	5	5
S5	Naturalization	5	5
Total Marks		25	25

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1		1	1			2				
CO2		2		1		2				
CO3				2		2				

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MEPC2019 : LAB- METROLOGY AND QUALITY CONTROL		
Teaching Scheme	**Examination Scheme**	
Practical: 2Hrs/Week	**ISE I**	**25 Marks**
Credits:01	**End Semester Evaluation**	**25 Marks**

Course Outcomes:

After completion of this course students will be able to:

	Course Outcomes
CO1	To apply knowledge of appropriate measuring instruments, gauges or comparators used to determine geometry and dimensions of components in engineering applications.
CO2	To perform experiments and experiments to analyze and interpret data used for quality control.
CO3	Analyze the measurement of the surface roughness.
CO4	To understand the advances in Metrology such as use of CMM, Laser, Machine Vision System for Metrology etc.
CO5	To understand of Quality Control Techniques and its applications in engineering industries.

List of the Experiments

The student shall perform minimum eight experiments of the following.

Sr. No.	Title of the Experiments	Skill / Knowledge Level
1	Demonstration and measurements by linear measuring instruments for linear measurements.	K1, K2, K3, K4, K5
2	Demonstration and measurements by limit gauges for gauging tolerances.	K1, K2, K3, K4, K5
3	Demonstration and measurements by different types of comparators like mechanical optical, electronic and pneumatic	K1, K2, K3

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4	Demonstration and measurements by different types of angular measuring instruments such as Venirebevel protector, universal bevel protector, sine bar, sine centre, angle gauges, optical instruments like auto collimator, angle dekkor,	K1, K2,K3
5	Testing of gears by gear rolling tester	K1, K2, K3
6	Demonstration and measurements of surface roughness by surface roughness measuringinstrument.	K1, K2, K3
7	Demonstration and measurements of screw thread parameters by using one wire, two and three wiremethods.	K1, K2, K3
8	Demonstration of interferometry applied to flatness,concave and convex testing.	K1, K2, K3
9	Industrial visit to understand the use of CMM and Laser Viewers for profile checks.	K1, K2
10	Demonstration and construction of control charts forvariables and attributes	K1, K2, K3, K4, K5

Assessment:

ISE I

The ISE I will consist of submitting a file for all the experiments with neatly written records of the study and diagrams.
The term work will be assessed by the course coordinator

End Semester Evaluation

The End Semester Evaluation will comprise of viva voce on the conducted practical's.
The End Semester Evaluation will be done by two examiners, one will be the course coordinator and other will be examiner appointed by DSB

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	End Semester Examination
K1	Remember	5	6
K2	Understand	5	6
K3	Apply	5	6
K4	Analyze	6	6
K5	Evaluate	4	4
K6	Create		
Total Marks		25	25

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Assessment Pattern Level No.	Knowledge Level	ISE I	End Semester Examination
S1	Imitation	6	6
S2	Manipulation	6	6
S3	Precision	6	6
S4	Articulation	6	6
S5	Naturalization	7	7
Total Marks		25	25

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1		3	3								1	1	
CO2	1		3	3								1	1	
CO3	1		3	3								1	1	
CO4	1		3	3								1	1	
CO5	1		3	3								1	1	
CO6	1		3	3								1	1	
CO7	1		3	3								1	1	
CO8	1		3	3								1	1	
CO9	1		3	3	1							1	1	
CO10	1		3	3								1	1	

3-High 2 – Medium 1 - Low

Special Instructions if any:

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MEPC2020 : WORKSHOP PRACTICE – III		
Teaching Scheme	**Examination Scheme**	
Practical: 2Hrs/Week	**ISE I**	**25 Marks**
Credits:01	**End Semester Evaluation**	**25 Marks**

Course Outcomes:

After completion of this course students will be able to:

	Course Outcomes
CO1	Enhancing the skills in operations like pattern making, moulding, sheet metal working and CNC Machining

List of the Experiments

Sr. No.	Title of the Experiments	Skill / Knowledge Level	CO
1	**Turning Shop:** Study of different operations to be carried on the lathe machine, Machining time calculations, taper turning methods (calculations), single point cutting tool operations, external threading, facing, finishing cuts, internal threading, safety precautions etc. **Job:** preparing a job on lathe machine performing the above operations individually	S1	CO1
2	**Machine shop:** study of different operations to be carried on the milling machine, the use indexing, gear cutting, slot cutting, spline cutting, and safety precautions etc. **Job:** preparing at least one job involving indexing operations spur gear cutting	S2	CO1
3.	**Grinding Shop:** study of different grinding operations and safety precautions. **Job:** preparing at least one job using grinding machine.	S3	CO1
4	Experimentation/ Preparing at least one job by using any one non-conventional machining processes.	S4	CO1

Assessment:

ISE I

The ISE I will consist of submitting a jobs for all the sections with neatly written recordsof the study and diagrams.

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The term work will be assessed by the course coordinator

End Semester Evaluation

The End Semester Evaluation will comprise of viva voce by conducting practical exam.The End Semester Evaluation will be done by two examiners, one will be the course coordinator and other will be examiner appointed by DSB

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	End Semester Examination
K1	Remember	4	4
K2	Understand	4	4
K3	Apply	4	4
K4	Analyze	5	5
K5	Evaluate	4	4
K6	Create	4	4
Total Marks		**25**	**25**

Assessment Pattern Level No.	Knowledge Level	ISE I	End Semester Examination
S1	Imitation	5	5
S2	Manipulation	5	5
S3	Precision	5	5
S4	Articulation	5	5
S5	Naturalization	5	5
Total Marks		**25**	**25**

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2	2		1					

3 – High 2 – Medium 1 – Low

Special Instructions if any:

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MEOE1020 : AUTOMATION ENGINEERING		
Teaching Scheme	**Examination Scheme**	
Lectures: 03 hrs/ week	**ISE I**	**15 Marks**
Tutorial: -	**ISE II**	**15 Marks**
Credits: 3	**ISE III**	**10 Marks**
	End Semester Examination	**60 Marks**

Prerequisites:NIL

Course description:
Automation is playing a key role in Industries. Industries rely heavily on automation for economic viability and mass production. It is important for the students to learn basic of automation, how system works and importance of PLC, SCADA and robots in automation. This course will provide opportunity to learn industrial automation techniques

Course Outcomes:

After completing the course, students will be able to:

	Course Outcomes
CO1	Understand the concept of automation and human factors
CO2	Designing a Pneumatic and Hydraulic system for a given application
CO3	Demonstrate the use of different sensors for automation
CO4	Design automation systems for a given application
CO5	Understand the circuit optimization techniques

Detailed Syllabus:

Unit 1	Introduction to Automation of different manufacturing processes, types of automation, degree of automation, technical, economic and human factors in automation
Unit 2	Types of systems - mechanical, electrical, electronics; Data conversion devices, transducers, signal processing devices, relays, contactors and timers. Sensors and their interfaces;
Unit 3	Hydraulics & Pneumatic Systems design and their application to manufacturing equipment; Sequence operation of hydraulic and pneumatic cylinders and motors; Electro Pneumatic & Electrohydraulic Systems design, Relay Logic circuits, Feedback control systems, PID Controller;
Unit 4	Drives and mechanisms of an automated system: stepper motors, servo drives. Ball screws, linear motion bearings, electronic caming and gearing, indexing mechanisms, tool magazines, and transfer systems.
Unit 5	Programmable Logic Controllers, I/Os, system interfacing, ladder logic, SCADA; Motion controller and their programming, PLC Open Motion Control blocks, Introduction to CNC control. automated guided vehicle systems.

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Text and Reference Books

1. Mikell P.Groover, "*Automation, Production Systems & Computer Integrated Manufacturing*" PHI Learning Pvt. Ltd. New Delhi, 3rd Edition 2012.
2. M.P.Groover , "*Automation, production systems and Computer-integratedManufacturing*" , Eastern Economy Edition, 2016.
3. Andrew Parr, " *Hydraulic and Pneumatics* ", Butterworth-Heinemann.ISBN:0750644192, 1999.
4. W Bolton., "*Mechatronics: Electronic Control Systems in Mechanical and ElectricalEngineering*" Prentice-Hall. ISBN: 0131216333, 2003.
5. Tiess Chiu Chang &Richard A. Wysk, "*An Introduction to Automated Process Planning Systems"* 1998.
6. Amber G.H & P.S. Amber, "*Anatomy of Automation*" PrenticeHall, 1962.

Assessment:

ISE I: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/Presentations/ Course Projects on First and Second unit.

ISE II: Shall be based on class test on third and fourth units.

ISE III: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/Presentations/ Course Projects on Fifth unit.

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

3 – High2 – Medium1 - Low

Course outcome	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1		3		2							3	3	3
CO2		3		1	2									
CO3				2	3					3			3	2
CO4		2		1	3				3			3	3	
CO5	1			3										

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	5	2	2	10
K2	Understand	5	1	2	10
K3	Apply	5	10	2	20
K4	Analyze		2	2	10
K5	Evaluate			2	10
K6	Create				
Total Marks 100		15	15	10	60

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Assessment table:

Assessment Tool	**K3**				
	CO1	CO2	CO3	CO4	CO5
ISE I (15 Marks)	7	8			
ISEII (15 Marks)			7	8	
ISEIII (10 Marks)	2	2	2	2	2
ESE Assessment (60 Marks)	12	12	12	12	12
Total Marks 100	21	22	21	22	14

Special Instructions if any:

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