Government College of Engineering, Aurangabad

(An Autonomous Institute)

Teaching and Evaluation Scheme from year 2023-24

Third Year B. Tech. Program in Mechanical Engineering

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-IX	MEPC3001	Machine Design - I	3	0	0	3	15	15	10	60	100
2.	PEC-II		**Professional Elective II**	3	0	0	3	15	15	10	60	100
3.	PCC-X	MEPC3004	CAD/CAM	3	0	0	3	15	15	10	60	100
4.	PCC-XI	MEPC3005	Fluid Mechanics & Hyd. Machines	3	0	0	3	15	15	10	60	100
5.	PCC-IX LC	MEPC3006	Lab-Machine Design- I	0	0	2	1	25			25	50
6.	PEC-II LC		Lab- **Professional Elective II**	0	0	2	1	25			25	50
7.	PCC-X LC	MEPC3009	Lab-CAD/CAM	0	0	2	1	25			25	50
8.	PCC-XI LC	MEPC3010	Lab- Fluid Mechanics &Hyd. Machines	0	0	2	1	25			25	50
9.	HSMC-II	MEHS0020	Industrial Organization & Management	3	0	0	3	15	15	10	60	100
10.	OEC-III		**Open Elective III**	3	0	0	3	15	15	10	60	100
11.	PROJ	MEPR3011	**Industrial Training***	-	-	2	1	25			25	50
12.	HSMC-IV$	MEHS0040	**Organizational Strategies**	3	0	0	3	15	15	10	60	100
Total				21	0	10	26	230	105	70	545	950

Professional Elective II

MEPE 3002 Theory of Machine

MEPE 3003 Mechanical Measurements

MEPE3007 Lab- Theory of Machine

MEPE3008 Lab - Mechanical Measurements

Open Elective III

MEOE0030 Quality Management Systems

MEOE0031 Renewable Energy Sources

- **Industrial Training*** - It is mandatory to all students to undergo one month (4 weeks) industrial training and has to submit the detail industrial report respective guides.

$ - Students can opt this course in offline mode OR NEPTEL/MOOCS/Swayam mode.
NPTEL/MOOCs : -It is mandatory to all students to successfully complete NPTEL/MOOC Course(s)at UG Engineering level (Totalof 12 weeks) will be equivalent for one Humanities Course of three credits and submit its certificate to COE through their guide.

- **The students have to Registered and complete NPTEL/MOOC Course(s) upto Vth Semester.**
- **Students must select NPTEL/MOOC course through the list provided by BOS Chairman Mechanical Engineering Department.**
- **After submission of authentic course certificate, credit of MEHS0040 will be transferred.**
  It is compulsory to appear online exam of Swayam/ NPTEL/ MOOCS course under supervision of department otherwise performanceof student will not be considered

Approved in XXVth Academic Council
Dated: 18th April 2023

Semester VI

Sr No	Category	Course Code	Course Title	Hours per week			Credits	Continuous Evaluation in terms ofMarks				Total
				L	T	P		ISE I	ISE II	ISE III	ESE	
1.	PCC-XII	MEPC3012	IC Engines	3	0	0	3	15	15	10	60	100
2.	PEC-III		**Professional Elective III**	3	0	0	3	15	15	10	60	100
3.	PCC-XIII	MEPC3015	Heat & Mass Transfer	3	0	0	3	15	15	10	60	100
4.	PEC-IV		**Professional Elective IV**	2	0	0	2	10	10	5	25	50
5.	PCC-XIILC	MEPC3018	Lab- IC Engines	0	0	2	1	25			25	50
6.	PEC-III LC		**Lab-Professional Elective III**	0	0	2	1	25			25	50
7.	PCC-XIIILC	MEPC3021	Lab-Heat & Mass Transfer	0	0	2	1	25			25	50
8.	PEC-IV LC		Lab-**Professional Elective IV**	0	0	2	1	25			25	50
9.	HSMC-III	MEHS1030	Engineering Economics and Costing	3	0	0	3	15	15	10	60	100
10.	OEC-IV		**Open Elective IV**	3	0	0	3	15	15	10	60	100
11.	PROJ	MEPR3024	CAME project	0	0	2	1	25			25	50
Total				17	0	10	22	210	85	55	450	800

Professional Elective III
MEPE3013 Power plant Engineering
MEPE3014 Machine Design - II
MEPE3019 Lab- Power plant Engineering
MEPE3020 Lab - Machine Design II

Professional Elective IV
MEPE3016 Tribology
MEPE3017 Advance Manufacturing Technology
MEPE3022 Lab - Tribology
MEPE3023 Lab - Advance Manufacturing Technology

Open Elective IV
MEOE1040 Entrepreneurship Development
MEOE1041 Operation Research

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MEPC3001: MACHINE DESIGN -I		
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: This course introduces undergraduate students to different parts of machines, failure criteria and conventional design procedures..

Course Outcomes:

After completing the course, students will be able to:

CO1	Understand the stresses and strains theories induced in a machine element.
CO2	Design different components as keys, cotters, couplings in a machine element
CO3	Apply knowledge to design different components as joints including riveted, bolted and welded joints.
CO4	Describe working of components as energy storing and releasing devices
CO5	Evaluate the various modes of failure of machine components under different load patterns..

Detailed Syllabus:

Unit 1	**Introduction and Design of Simple Machine Parts** Introduction of Machine Design, Basic procedure of Machine Design, Requisites of design engineer, Design of machine elements, Sources of design data, Use of standards in design, Selection of preferred sizes. Simple Stress, Thermal Stresses, Impact Stress, torsional stress, Poisson's Ratio, Volumetric Strain, Young's Modulus, Theories of Failures. Stress Concentration – Causes & Remedies. Design of Simple parts – Knuckle joint & Cotter joint)
Unit 2	**Shafts, Keys and Couplings** **Shafts** :-Material, Design on the basis of strength considering shaft subjected to, twisting moment only, bending moment only, Combine twisting and bending moment, axial load in addition to twisting and bending. Design on the basis of rigidity. A.S.M.E. code for shaft design, **Keys**:-Classification of keys, Design considerations in parallel and tapered sunk keys, Design of square, flat and Kennedy keys, Splines. **Couplings**:-Design considerations, Classification, Design of Rigid, Muff coupling, Flange coupling and Flexible bushed pin coupling

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Unit 3	**Temporary and Permanent Joints** **Threaded Joints:-** Different Forms of Threads, Bolts of uniform strength, Locking devices, I.S.O. metric screw threads, Stresses in threaded joint, eccentrically loaded bolted joint, Torque requirement for bolt tightening. **Welded Joints: -** Types of welding and joints, strength of transverse and parallel fillet welded section, axially loaded unsymmetrical welded section, eccentrically loaded joint **Note:** Numerical should be asked on eccentrically loaded bolt joint and axially loaded unsymmetrical welded section, eccentrically loaded joint.
Unit 4	**Energy Storing Elements** **Flywheel:** - Function and material, Torque Analysis, coefficients of fluctuation of energy, Solid disk Flywheel, Rimmed Disk flywheel, stresses in flywheel rim. **Spring:-** Types, Applications and materials of springs, Stress and deflection equations for helical springs, Style of ends, Wahl's Stress Factor, Design of helical compression and tension springs, Springs in series and parallel, Concentric helical springs, leaf spring, Shot peening **Note:** Numerical should be asked on Solid Disk and Rimmed Disk Flywheel and Design of Helical springs and Leaf spring.
Unit 5	**Fluctuating Loads and Statistical consideration in Design** **Design for Fluctuating Loads**: Stress concentration – causes and remedies, Fluctuating stresses, Fatigue failure, Endurance limit, Notch sensitivity, Reversed stresses, Solderberg and Goodman diagrams, Fatigue design of components under combined stresses such as shafts, bolts and springs. **Statistical consideration in design**: - Design and natural tolerances –Design for assembly- Statistical analysis of tolerances – Mechanical reliability and factor of safety

Text and Reference Books

[1] Shigley J.E. and Mischke C.R., "Mechanical Engineering Design", Tata McGraw Hill Publication Co. Ltd.
[2] Spotts M.F. and Shoup T.E. , "Design of Machine Elements", Prentice Hall International.
[3] Bhandari V.B., "Design of Machine Elements", Tata McGraw Hill Publication Co. Ltd.
[4] FArzdak Haideri, "Machine Desig", Nirali Prakashan, Pune.
[5] Willium C. Orthwein, "Machine Components Design", West Publishing Co. and Jaico Publications House.
[6] Design Data", P.S.G. College of Technology, Coimbatore. B. Cheatham, Mechanical Analysis and Design, 2 nd Ed., Prentice Hall

Mapping of Course outcome with Program Outcomes and 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
CO1	1				3								1	
CO2		2		1						2				1
CO3														
CO4	3					1							1	
CO5			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.

Assessment Pattern:

Assessment Pattern LevelNo.	**KnowledgeLevel**	**ISE I**	**ISE II**	**ISE III**	**End Semester Examination**
K1	Remember	5	5		
K2	Understand	5	5		12
K3	Apply	5	5	5	24
K4	Analyze			5	12
K5	Evaluate				
K6	Create				12
Total Marks 100		15	15	10	60

Assessment table:

Assessment Tool	**K2.K3**	**K2,K3**	**K3**	**K4**	**K3,K4**
	CO1	CO2	CO3,CO4	CO4	CO5
ISE I (15 Marks)	7	8			
ISE II (15 Marks)		5	5	5	
ISE III (10 Marks)			5	5	
	K2 to K4,K6	**K2 to K4,K6**	**K2 to K4,K6**	**K2 to K4,K6**	**K2 to K4,K6**
ESE Assessment (60 Marks)	12	12	12	12	12

Special Instructions if any: Nil

Designed by: Mr. Sachin Chaudhari

Approved in XXVth Academic Council
Dated: 18th April 2023

MEPC3006 : LAB MACHINE DESIGN-I		
Teaching Scheme	**Examination Scheme**	
Practical: 02 hrs/ week	**ISE I**	**25 Marks**
	ISE II	**-**
Credits:01	**ISEIII**	**-**
	ESE	**25 Marks**

Course description:

The course aims at imparting knowledge of Machine Design procedure for different elements.

Course Outcomes:

After completing the course, students will be able to:

CO1	understand the working principles of machine elements
CO2	design and prepare part and assembly drawings
CO3	use design data books and different codes of design

Detailed Syllabus:

Part I	Term work shall consist of "ONE" design project. The design project shall consist of assembly drawing with a part list and overall dimensions and the other sheet involving drawing of individual components using AUTO CAD on A3 size paper. Manufacturing tolerances, surface finish symbols and geometric tolerances should be specified so as to make it working drawing. A design report giving all necessary calculations of the design of the components and assembly should be submitted in a separate file. 2. Design projects should include selection of prime mover and design of mechanical systems comprising of machine elements: Design data book shall be used extensively for the selection of the components.
Part II	Total five assignments (One on each unit - only Numerical)

Assessment:
ISE I: Shall be on the basis of assessment of term work.
ESE: ESE will based on oral exam conducted by course coordinator and external examination.

Mapping of Course outcome with Program Outcomes and 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
CO1	1	2											3	
CO2			3							1				1
CO3	1			2										

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Assessment Pattern:

Assessment Pattern LevelNo.	**Knowledge Level**	**ISE I**
S1	Imitation	5
S2	Manipulation	10
S3	Precision	10
S4	Articulation	
S5	Naturalization	
S6		
Total Marks 50		25

Assessment table:

Assessment Tool	**S1 to S3**	**S1,S2**
	CO1	CO2
ISE I (15 Marks)	15	10
Total Marks 50	15	10

Special Instructions if any: Nil

Designed by: Mr. Sachin Chaudhari

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Dated: 18th April 2023

MEPE3002:THEORY OF MACHINES	
Teaching Scheme **Lectures:3Hrs./Week** **Credits: 3**	**Examination Scheme** **ISE I :15 Marks** **ISE II :15Marks** **ISE III : 10 Marks** **End Semester Exam : 60 Marks**

Course Description:

This course aims to equip the student with fundamental knowledge of dynamics of machines so that they can appreciate problems of dynamic force balance, transmissibility of forces. Students learn how to model simple mechanical systems as the problem of vibrating systems, governors, gyroscope, brakes and dynamometers and then analyze these systems. Once these analytical skills have beendeveloped, the students can apply these skills to the practical problems.

Course Objectives

1. To determine the balancing of masses of rotating and reciprocating machine elements
2. To understand the principles of gyroscope and governors
3. To determine the forces and power calculations for brakes and dynamometer
4. To determine the static and dynamic forces for mechanical systems
5. To understand the principles of vibrations

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

CO1	Explain the principles of balancing of rotary and reciprocating masses.
CO2	Apply the principles of governor and its stabilization on various transport vehicles.
CO3	Analyze the force and power generated in brakes and dynamometer.
CO4	Evaluate static and dynamic force and design dynamically equivalent systems.
CO5	Understand the principles of vibrations.

Detailed Syllabus:

Unit 1	**Balancing:** Static balancing, dynamic balancing, balancing of several masses in different planes, force balancing of linkages, balancing of reciprocating mass, balancing of locomotives, effect of partial balancing in locomotives, balancing of inline engines, balancing of V,W,V-8 and V-12 engines, balancing of radial engines.
Unit 2	**Governor:** Introduction to centrifugal & inertia types governor, classification,Watt, porter, prowell spring loaded governor, Sensitivity & stability, Force diagram (Numerical)

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Unit 3	**Brake & Dynamometers:** Introduction, brake materials, types of brakes, shoe brake, pivoted shoe brake, double block brake, simple and differential block brake, band and block brake, braking force, braking torque calculations, internal expanding brake, normal pressure braking force, braking torque, braking of vehiclewhen brake is applied on real wheel, front wheel , four wheels ,Types of dynamometer, rope brake, epicyclic train ,belt transmission, torsion and eddy current dynamometer, fluid coupling and dynamometer, Numerical treatment.
Unit 4	**Static and Dynamic force analysis:** Static equilibrium, equilibrium of two and three force members, equilibrium of four forces and torque, force convention and free body diagrams. D'Alemberts principle, equivalent offset inertia force, dynamic analysis of four link mechanism and slider crank mechanism, Angular velocity and acceleration of connecting rod, engine force analysis.
Unit 5	**Vibration:** Introduction, Definitions, Types of vibration, Basic features of vibrating system, cause effects and terminology, degree of freedom, Free longitudinal vibration, displacement, velocity and acceleration, Inertia effect of the mass of spring, Damped vibration, logarithmic decrement, forced vibration, forced damped vibration, free torsional vibration (Single and Two rotor system).

Text Books

1. Rattan, "Theory of machine", Tata McGraw-Hill Publishing Co. Ltd, New Delhi
2. P. Ballaney, "Theory of machine", Khanna Publication, New Delhi
3. JagdishLal, "Theory of machine and Mechanisms", Metropolitan publication
4. Thomas Beven, "Theory of machine", C B S Publisher
5. K. G. Grover, "Mechanical vibration", New Chand publication, New Delhi

Reference Books

1. Shigley and Vicker, "Theory of machine", McGraw-Hill Publishing Co. Ltd, New Delhi
2. J. S. Rao& R. V. Dukkipati, Mechanism & Machine Theory, New Age Publication

Mapping of Course outcome with Program Outcomes

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

1 – High 2 – Medium 3 – Low

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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.

Assessment Pattern

Assessment Pattern Level No.	**Knowledge Level**	**ISE I**	**ISE II**	**ISE III**	**End Semester Examination**
K1	Remember	03	03	00	10
K2	Understand	05	05	05	10
K3	Apply	03	03	05	20
K4	Analyze	02	02	00	20
K5	Evaluate	03	03	00	00
K6	Create	00	00	00	00
Total Marks 100		15	15	10	60

Assessment table

Assessment Tool	K1	K2	K3	K4	K3
	CO1	CO2	CO3	CO4	CO5
Class Test-1 (15 Marks)	05	03	02	05	00
Class Test-2(15 Marks)	05	03	02	00	05
Teachers Assessment (10 Marks)	03	01	01	03	02
ESE Assessment (60 Marks)	10	10	10	20	10

Special Instructions if any: Nil

Designed by : Dr.S.D.Ambekar

Approved in XXVth Academic Council
Dated: 18th April 2023

MEPE3007: LAB THEORY OF MACHINES	
Teaching Scheme **Practical:2hrs/week** **Credits:1**	**Examination Scheme** **ISE I : 25marks** **ESE : 25marks**

Course Outcomes:

CO1	Explain the effects of forces in static and dynamic balancing
CO2	Express the effect of various forces, Speed, and acceleration analysis of various governors
CO3	Analysis and evaluation of braking force ,torque of brakes and dynamometer
CO4	Analyse & Justify the suitability of conventional and non-conventional fuels for IC engines
CO5	Understand various types of vibrational principles

Term work	
Term work shall consists of record of the following experiments	
1.	To draw, solve and calculate the force analysis of static force analysis/ balancing of rotating masses (Min. four problems)
2.	To draw, solve and calculate the force analysis of dynamic force analysis/reciprocating masses/V,W,V-8 and V-12 (Min. four problems).
3.	Trial on any two types of governors
4.	To understand the working and design principle Solve the problems on various types of brakes
5.	To understand the working and design principle Solve the problems on various types of Dynamometers
6.	To Solve the problems on static and dynamics force analysis of various machine parts (Min Five)
7.	To perform any three practical based on vibration like Simple/.compound pendulum/whirling speed of shaft, torsional vibration/damping vibration etc

Assessment:
ISE I: Shall be on the basis of assessment of term work.
ESE: ESE will based on oral exam conducted by course coordinator and external examination.

Mapping of Course outcome with program outcome

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

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Assessment table

Assessment Tool	**S1**	**S2**	**S3**	**S2**	**S2**
	C01	C02	C03	CO4	CO5
ISE I	10	10	02	02	01

Assessment Pattern

Assessment Pattern Level No.	**Knowledge Level**	**ISE I**
S1	Implementation	04
S2	Manipulation	07
S3	Precision	14
S4	Articulation	00
S5	Naturalization	00
Total Marks 50		25

Designed by: Dr.S.D.Ambekar

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MEPE3003: MECHANICAL MEASUREMENT		
Teaching Scheme	**Examination Scheme**	
Lectures: 03 hrs./ week	**ISE I**	**15Marks**
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 different measuring devices. Topics range from an overview of basic measuring instruments and systems with their characteristics, different displacement, vacuum, strain, pressure, angular velocity, acceleration and temperature measurement techniques in details..

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

	Course Outcomes
CO1	understand the use and principles of measuring devices.
CO2	know the generalized measurement system, errors, transducers, intermediate modifying and terminating devices.
CO3	explain the working of various measuring instrument
CO4	enable students to select particular instrument according to application.

Detailed Syllabus:

Unit 1	**Significance of Mechanical Measurements**, Classification of measuring instruments, generalized measurement system, types of inputs: Desired, interfering and modifying inputs. Static characteristics: Static calibration, Linearity, Static Sensitivity, Accuracy, Static error, Precision, Reproducibility, Threshold, Resolution, Hysteresis, Drift, Span & Range etc. Error in measurement: Types of errors, Effect of component errors on combination and distribution of combination errors on components, Probable errors
Unit 2	**Displacement measurement:** Transducers for displacement measurement, Potentiometers, LVDT, Capacitance type, Digital transducers (optical encoder), Nozzle flapper transducer.
Unit 3	**Measurement of angular velocity:** Tachometers, Tacho-generators, digital tachometers and stroboscopic methods **Acceleration Measurement:** Theory of accelerometers and vibro-meters, Practical Accelerometers, strain gauge based and piezoelectric accelerometers
Unit 4	**Pressure measurement:** Pressure standards, Elastic pressure transducers viz. Bourdon Tubes, Diaphragm, Bellows and piezoelectric pressure sensors. High−pressure measurements, Bridgman gauge **Vacuum measurement:** Vacuum gauges viz. McLeod gauge, Ionization and Thermal Conductivity gauges.

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Unit 5	**Temperature measurement: Resistance thermometers, Thermistors and Thermocouples, Pyrometers** Strain measurement**:** Theory of Strain Gauges, Gauge factor, Temperature compensation, Bridge circuit, Orientation of Strain Gauges for Force and Torque measurement, Strain Gauge based Load Cells and Torque Sensors

Text and Reference Books

1. Sawhney A K, "Mechanical Measurements and Instruments", Dhanpat Rai& Sons. New Delhi. 2018
2. Rangan C. S, Sarma G. R.," Instrumentation Devices and Systems", Tata McGraw Hill, Delhi 2017
3. E. O. Doebelin, "Engineering Experimentation: planning, Execution, Reporting", McGraw Hills Int. Edition 2020
4. Thomas Beckwith, N. Lewis Buck, Roy Marangoni, "Mechanical Engineering Measurement", Narosa Publishing House, Bombay 2019

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	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

3 – High 2 – Medium 1 - Low

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 LevelNo.	KnowledgeLevel	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	5	03		15
K2	Understand	5	07	02	15
K3	Apply	5	05	02	15
K4	Analyze			06	15
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 (15Marks)			8	7
ISE III (10 Marks)	02	03	02	3
ESE Assessment (60Marks)	10	20	15	15
Total Marks 100	19	31	25	25

Designed by: Prof.M.S.Harne

Approved in XXVth Academic Council
Dated: 18th April 2023

MEPE3008 : LAB MECHANICAL MEASUREMENTS		
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	Apply knowledge of principles of various sensors and transducers for measuring System
CO2	Explain knowledge of displacement, strain measuring instrument for practical /real life situation and setting the instruments for zero error adjustment.
CO3	use knowledge of Angular velocity, pressure measuring instrument for practical /real life situation and analyze its characteristics.
CO4	Understand knowledge of Temperature, acceleration measuring instrument for practical /real life situation

List of the Experiments

The student shall perform minimum five experiments

Sr. No.	**Title of the Experiments**
1	Study and demonstration of generalized measurement system with a typical instrument
2	Measurement of displacement using any one displacement measuring instrument, setting the instruments forzero error adjustment.
3	Measurement of strain using strain gauge
4	Measurement of pressure using any one pressure measuring instrument and setting the instruments forzero error adjustment
5	Measurement of temperature using RTD/Thermocouple/pyrometer and analyzing its Characteristics
6	Measurement of optical Sensor
7	Measurement of speed using any one speed measurement instrument

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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.

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 LevelNo.	**Knowledg eLevel**	**ISE I**
S1	Imitation	05
S2	Manipulation	05
S3	Precision	05
S4	Articulation	05
S5	Naturalization	05
Total Marks		25

Assessment table:

Assessment Tool	**S1 to S3**	**S3 to S5**
5	CO1 to CO3	CO2 to CO4
ISE I (15 Marks)	15	10
Total Marks 50	15	10

Designed by: Prof.M.S.Harne

Approved in XXVth Academic Council
Dated: 18th April 2023

MEPC3004:CAD/CAM		
Teaching Scheme	**Examination Scheme**	
Lectures:03hrs./week	**ISEI**	**15Marks**
Tutorial:00hrs./week	**ISEII**	**15Marks**
Credits :03	**ISEIII**	**10Marks**
	End Semester Examination	**60Marks**

Course description: The aim of this course is to develop an understanding of the basic principles of Computer aided tools used in engineering to develop students' attentiveness in the application of CAD and CAM .To study CAM and NC Part Programming, Computer Assisted Part Programming

To be acquainted knowledge of the concepts like Group technology (GT), Flexible manufacturing systems (FMS), CAPP etc.

Course Outcomes:

After completing the course, students will be able to:

	Course Outcomes
CO1	Recognize the proper computer graphics techniques for geometric modeling and transform object using various transformation methods.
CO2	Use analytical and synthetic curves and surfaces techniques in part modeling
CO3	Generate tool path for part for CNC Programming and to Develop CNC manual part program and APT part Program
CO4	Determine the various rapid manufacturing techniques and improve capability in designing and developing products using rapid manufacturing technology.
CO5	Understand the robotic systems and their applications in manufacturing industries

Detailed Syllabus:

Unit1	**Fundamentals of CAD/CAM and Transformation:** Product cycle on CAD/CAM product features of CAD/CAM software. Geometric transformation. 2D and 3D Transformation, Translation, Rotation, Scaling, Reflection, Homogenous transformation, geometric concatenation, mapping, Orthographic transformation,
Unit2	**Mathematical Representation of Curves and Surfaces and Solid Modeling** Design of curves, parametric space of curves Blending function. Analytic curves, line circle parabola ellipse, hyperbola Synthetic curves, Hermite cubic spline, Bezier curves, B-spline curves introduction to NURBS. Design of surfaces, Analytical surfaces, synthetic surfaces, parametric space of a surface, cylindrical surface ruled surface, surface of revolution. Introduction to Bezier surface spine surface, B-Spline surface. Solid Modeling fundamentals, topology and geometry, Requirements of Geometric Modeling generalize concept of boundary set theory, Euler's operator. Geometric Modeling Method, Constructive Solid Geometry (CSG), Boundary Representation (Brep), Introduction to Wireframe, surface and solid modeling techniques. Introduction CAD data exchange format IGES, STEP

Unit3	**Computer Aided Manufacturing (CAM)** Introduction to automation. Need and future of NC, CN and CAM. Basic component of NC, Dimensioning, axes designation for Various Machine Tools NC motion control Introduction to Part programming, G and M Codes APT (Automatically Programmed Tool)Part programming, Problems on Programming For Drilling Turning and Milling
Unit4	**Rapid Prototyping and Manufacturing:** Introduction to Rapid Prototyping (RP). Principle and advantages of Rapid Prototyping. Different techniques of Rapid prototyping and their applications. Advantages, accuracy economics consideration of Rapid prototyping.
Unit 5	**Robotics** Definition of Robot by RIA (Robotic Industries Association), Classification of robots, robot anatomy, Point to point and continuous path robotic systems, Joints, End Effectors, Grippers - Mechanical, Magnetic and Pneumatic, Applications

Text and Reference Books

1) Ibrahim Zeid and R. Sivasubramanian - CAD/CAM - Theory and Practice Tata McGraw Hill Publishing Co. 2009
2) S. R. Deb, Robotics Technology and Flexible Automation, Tata McGraw Hill.
3) Kundra T. K., Rao P. N. and Tewari M. K., "Numerical Control and Computer Aided Manufacturing", Tata McGraw Hill, 1990.
4) Groover M.P. and Zimmers E.W., "Computer Aided Design and Manufacturing ", Prentice Hall India, 1997.
5) Rao P N., "CAD/CAM Principles and Applications ", Tata McGraw Hill, 2006
6) Adithan, M. , Pabla, B.S. ," CNC Machines", New Age International (P) Ltd

Mapping of Course outcome with Program Outcomes and 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
CO1	3	1												2
CO2	3	2												
CO3	3	2		1									1	
CO4			3		1								1	
CO5			3		1								1	

Assessment:

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

ISE II: Shall be based on class test.

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

Assessment Pattern:

Assessment Pattern Level No.	**Knowledge Level**	**ISEI**	**ISEII**	**ISE III**	**End Semester Examination**
K1	Remember	5	03		15
K2	Understand	5	07	02	15
K3	Apply	5	05	02	20
K4	Analyze			06	10
K5	Evaluate				
K6	Create				
TotalMarks100		15	15	10	60

Assessment table:

Assessment Tool	**K1andK2**	**K2andK3**	**K2andK3**	**K2andK3**
	CO1	CO2	CO3	CO4
ISEI(15 Marks)	7	8		
ISEII (15Marks)			8	7
ISEIII (10 Marks)	02	03	02	3
ESE Assessment(60Marks)	10	20	15	15
Total Marks 100	19	31	25	25

Designed by: Prof.Sayali Kulkarni

Approved in XXVth Academic Council
Dated: 18th April 2023

MEPC3009 : Lab CAD/CAM		
Teaching Scheme	**Examination Scheme**	
Practical: 2 Hrs/Week	**ISEI**	25 Marks
Credits :01	**End Semester Examination**	25 Marks

Course Outcome

As an outcome of completing the Laboratory course, students will able to

1) Study of program in C or MATLAB for 2 D Transformations
2) Create program in C or MATLAB for graphical output of any one type of curve / surface
3) Design 3 D Models on any CAD software like Pro/E, UG, CATIA, etc.
4) Developed any four part programs lathe and milling operations

List of Experiment

1) Developing program in C or MATLAB for 2 D Translation Transformations
2) Developing program in C or MATLAB for 2 D Rotation Transformations
3) Developing program in C or MATLAB for any one type of curve eg. B spline
4) Creating 3 D Model of given assembly in any CAD software
5) Study and classification of part family using Group Technology
6) Developing any four part programs out of the following lathe and milling operations
    a) Plain turning and facing
    b) Taper Turning
    c) Thread Cutting
    d) Plain Milling
    e) Key way Milling
    f) Pocket Milling
7) Industrial visit to study the following CNC systems or Automation Industry and write detail Report.

Mapping of Course outcome with Program Outcomes and 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
CO1	3		2											
CO2	3		2											
CO3	3	3	2										2	1
CO4	3		2										3	2

Approved in XXVth Academic Council
Dated: 18th April 2023

Assessment Pattern:

Assessment Pattern Level No.	**Knowledge Level**	**ISEI**
S1	Imitation	05
S2	Manipulation	05
S3	Precision	05
S4	Articulation	05
S5	Naturalization	05
Total Marks		25

Assessment table:

Assessment Tool	**S1 to S3**	**S3 to S5**
	CO1 to CO3	CO2 to CO4
ISE I (15 Marks)	15	10
Total Marks 50	15	10

Special Instructions if any: Nil

Designed by: Prof. Sayali Kulkarni

Approved in XXVth Academic Council
Dated: 18th April 2023

MEPC3005: FLUID MECHANICS & HYD. MACHINES		
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: In this course we are going to learn fluid properties and fluid statics buoyancy forces and different kinds of equilibrium of floating bodies also we are going to learn fluid kinematics and fluid dynamics, dimension analysis and flow through pipes and various types of pumps impeller and casings.

Course Outcomes:

After completing the course, students will be able to:

CO1	Understand the various properties of fluids
CO2	Apply the principles of fluid statics, kinematics and dynamics for various engineering applications.
CO3	Evaluate the performance of different hydraulic machinery
CO4	Explain the concept of fluid flow through pipes.
CO5	Evaluate the performance of centrifugal pumps.

Detailed Syllabus:

Unit 1	**Fluid Properties & Fluid Statics** Definitions of fluid & fluid mechanics, properties of fluids like viscosity, surface tension, capillarity etc., types of fluids, illustrative examples, Definition of Fluid Statics, pressure in fluids at rest, Pascal's law, manometry, total pressure, center of pressure, hydrostatic forces on immersed plane and curved surfaces, buoyancy, metacenter and metacentric height, different kinds of equilibrium of floating bodies, illustrative examples
Unit 2	**Fluid Kinematics & Fluid Dynamic**s Definitions of stream line, path line, streak line, stream tube, types of fluid flows, continuity equation in Cartesian and cylindrical co-ordinates, illustrative examples Euler's equation of motion, Bernoulli's equation from Euler's equation, energy correction factor, practical applications of Bernoulli's equation, momentum equation, momentum correction factor, engineering applications of momentum equation such as force on pipe bend and jet propulsion of ships, illustrative examples
Unit 3	**Dimensional Analysis & Flow through Pipes** Dimensions of different fluid parameters, Buckingham's pie theorem, different dimensionless groups, physical meaning of dimensionless groups, types of similarities, laws of similitude, practical applications, illustrative examples, Loss of energy in pipes, major and minor losses, Hydraulic Gradient Line (HGL) and Total Energy Line (TEL), flow through series pipes, parallel pipes and branched pipes, equivalent pipe, power transmission through pipes, condition for maximum power transmission, efficiency for maximum power transmission, water hammer in pipes, illustrative examples, Rayleigh's equation.
Unit 4	**Impulse Turbines & Reaction Turbines** Impact of jet, force of jet impinging on fixed and moving flat plate, fixed and moving curved plate, hinged plate, series of moving plates, illustrative examples Introduction to turbines, types of turbines, efficiencies of turbines, work done by an impulse turbine, power produced by an impulse turbine, Pelton turbine and its components, design of Pelton wheel, governing of Pelton wheel, illustrative examples Components of a reaction turbine, difference between impulse and reaction turbines,

	classifications of reaction turbines, efficiencies of reaction turbines, Francis Turbine, Kaplan Turbine, draft tube, types of draft tubes, efficiency of draft tube, unit power, unit speed, unit discharge, specific speed of a turbine, significance of specific speed, cavitation in turbines
Unit 5	**Centrifugal Pumps.** Introduction, types of pumps, types of impellers, types of casings, priming, various heads & efficiencies of centrifugal pump, minimum starting speed of a centrifugal pump, multistage centrifugal pump, performance of pumps, principles of similarity applied to centrifugal pump, specific speed, NPSH, cavitation in pumps, illustrative examples

Text and Reference Books

1. Bansal R. K., "Fluid Mechanics and Hydraulic Machines", Laxmi Publications (P) Ltd. New Delhi 14
2. Modi and Seth, "Fluid Mechanics and Hydraulic Machines", Standard Book House, New Delhi 3. Jagdish Lal, "Hydraulic Machines", Metropolitan Book Company
4. Durgaiah Rama D., "Fluid Mechanics and Hydraulic Machines", New Age International, New Delhi
5. E. H. Shames, "Fluid Mechanics", McGraw Hill Publications
6. Streeter and Wylie, "Fluid Mechanics", McGraw Hill Publications
7. Rajput R. K., "Fluid Mechanics", S. Chand and Co., New Delhi

Mapping of Course outcome with Program Outcomes and Program Outcomes

3 – High 2 – Medium 1 – Low

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

Approved in XXVth Academic Council
Dated: 18th April 2023

Assessment Pattern:

Assessment Pattern LevelNo.	Knowledg eLevel	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	3	3	2	10
K2	Understand	4	4	2	10
K3	Apply	3	3	2	20
K4	Analyze	5	5	2	20
K5	Evaluate			2	
K6	Create				
Total Marks 100		15	15	10	60

Assessment table:

Assessment Tool	K2.K3	K2,K3	K3	K4	K3,K4
	CO1	CO2	CO3,CO4	CO4	CO5
ISE I (15 Marks)	7	8			
ISE II (15 Marks)		5	5	5	
ISE III (10 Marks)			5	5	
	K2 to K4,K6	**K2 to K4,K6**	**K2 to K4,K6**	**K2 to K4,K6**	**K2 to K4,K6**
ESE Assessment (60 Marks)	12	12	12	12	12
Total Marks 100	19	25	22	22	12

Special Instructions if any: Nil

Designed by: Mr. Jitendra Dighe

Approved in XXVth Academic Council
Dated: 18th April 2023

MEPC3010 : LAB-FLUID MECHANICS AND HYDRAULIC MACHINES		
Teaching Scheme	**Examination Scheme**	
Practical: 02 hrs/ week	**ISE I**	**25 Marks**
Credit: 1	**ESE**	**25 Marks**

Course description:
The course aims at imparting knowledge of Machine Design procedure for different elements.

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

CO1	Ability enhancement in practical determination of fluid viscosities and to decide the flow patterns
CO2	Ability enhancement in applying Bernoulli's theorem & momentum principle to various flow patterns
CO3	Ability enhancement in applying theoretical knowledge to find the performance of different turbines and pumps

Detailed Syllabus:

List of Experiments

Sr. No.	Details
1	Experiment on Red wood viscometer
2	Experiment on Reynolds's apparatus
3	Experiment on Bernoulli's theorem
4	Experiment on flow measurement by orifice & venturimeter
5	Experiment on verification of momentum principle
6	Experiment on determination of force due to impact of jet
7	Experiment on determination of metacentric height of a floating body
8	Experiment on flow through pipes

Assessment:
ISE I: Shall be on the basis of assessment of term work.
ESE: ESE will based on oral exam conducted by course coordinator and external examination.

Approved in XXVth Academic Council
Dated: 18th April 2023

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

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

3 – High 2 – Medium 1 - Low

Assessment Pattern:

Assessment Pattern LevelNo.	**Knowledge Level**	**ISE I**
S1	Imitation	5
S2	Manipulation	10
S3	Precision	10
S4	Articulation	
S5	Naturalization	
S6		
Total Marks 50		25

Assessment table:

Assessment Tool	**S1 to S3**	**S1,S2**
	CO1	CO2
ISE I (15 Marks)	15	10
Total Marks 50	15	10

Special Instructions if any: Nil

Designed by: Mr. Jitendra Dighe

Approved in XXVth Academic Council
Dated: 18th April 2023

MEPR3011: INDUSTRIAL TRAINING		
Teaching Scheme	**Examination Scheme**	
Practical : 2 hrs/week	**ISE I**	**25 Marks**
Credits: 01		

Course description: After completing this course, students will have a broad and fundamental understanding of concerned Industry, Industrial activities , Industrial behavior. Student will understand the Industrial layouts/Plant layout, process layouts, Manufacturing processes, Standard Quality Control Practices. Students should understand the purchase and sales process, reduction of scrap or wastages of material. Student get conversant with Standard Inventory Control, Costing and Cost Control

Course Outcomes:

After completing the course, students will be able to:

CO1	understand various industrial aspects.
CO2	develop professional ethics required to work in industry.
CO3	emphasizes intuitive, understanding and practical implementations of the theoretical concepts.

Detailed Syllabus:

General Guidelines to students for Industrial Training

- Students shall undergo industrial in-plant Training for the period of four (4) week .
- Students shall undergo training after third and fourth semester's vacation.
- Students shall undergo training in small/medium/large multi-national Industry or shall to visit various departments or government industry or Research Centre.
- Industrial training co-ordinator of department shall allot Faculty Advisor to this Course. It is duty and responsibility of Faculty Advisor to give the standard formats of Industrial report and contact with the industries authorities and support the students to gather technical information.
- **Term Work**:

The student shall submit detail report on for Industrial Training Term Work Term work shall consist of a comprehensive report based on student's observations, training received during four week of training. The report shall also include drawings, figures, process sheets, machine/ product specifications etc. Students shall obtain a Certificate of successful completion of training from concerned industry authority in standard format.

Approved in XXVth Academic Council
Dated: 18th April 2023

Mapping of Course outcome with Program Outcomes and Program Outcomes

3 – High 2 – Medium 1 – Low

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

Assessment:

ISE I: Shall be on the basis of assessment of term work.

Designed by: All BoS Members

Approved in XXVth Academic Council
Dated: 18th April 2023

MEHS0040 : Organizational Strategies	
Teaching Scheme **Lectures: 3Hrs/Week** **Credits : 03**	**Examination Scheme** **ISE I : 15 Marks** **ISE II : 15 Marks** **ISE III : 10 Marks** **End Semester Exam : 60 Marks**

Course Description: The course focuses on the concept of strategy formulation and implementation by exploring the functions and nature of general management. The course serves as an opportunity to develop skills for strategic thinking and analysis, cross-functional integration

Course Outcomes:

After completion of this course students will be able to:

CO1	Describe the life of a product from cradle to grave
CO2	Estimate the exact quantity of sales
CO3	Predict the admissible quality of a product.
CO4	Analyze the exact order quantity of recourses required
CO5	Estimate the material requirement for a particular product

Content

UNIT 1:	Product Life Cycle, Value Engineering Concepts, Design for X (DFX), Ergonomics in Product Design, Rapid Prototyping: Concept, Advantages.
UNIT 2:	Sales Forecasting, Forecasting System, Qualitative Methods of Forecasting, Quantitative Methods - I, Quantitative Methods – I.
UNIT 3:	Concept of Quality, Total Quality Management (TQM), Total Productive Maintenance (TPM), Statistical Quality Control, (SQC), Six Sigma.
UNIT 4:	Materials Management, Inventory Control, Economic Order Quantity (EOQ) Models, Economic Order Quantity (EOQ): Problems, Production Quantity Model.
UNIT 5:	Just in Time (JIT), Kanban System, Materials Requirement Planning (MRP)-I, Materials Requirement Planning (MRP)-II, Enterprise Resource Planning (ERP).

TEXT AND REFERENCE BOOKS

1. O. P. Khanna, "Industrial Organization and Management, Khanna Publications
2. D. Ravindra Prasad and V. S. Prasad, Admistrative Thinkers, Sterling Publishers, New Delhi
3. Operation Management: K. N. Dervitsiotis, McGraw-Hill International Company.
4. Operations Management: R.S. Russell, and B.W. Taylor, Pearson Education
5. Industrial Engineering and Production Management: M. Telsang, S. Chand & Company Ltd.
6. Paul Hersey, Management of organisation behavior, Pearson Prentice Hall
7. D. Gvishiyani, Organisation and Management, Progress Publishers, Moscow

Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1				2									1	
CO2	1					1								
CO3		1												2
CO4			3	2										
CO5				3										

3 – High 2 – Medium 1 – Low

Assessment:

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

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

ISE III: Shall be based on Class Tests/ Assignments/ Quizzes/ Field visits/Presentations/ Course Projects on Fifth unit

Approved in XXVth Academic Council
Dated: 18th April 2023

Recommended Assessment Pattern

Assessment Pattern Level No.	Knowledge Level	Test	Teachers Assessment/ Assignment	End Semester Examination
K1	Remember	15	00	20
K2	Understand	15	05	30
K3	Apply	00	05	10
K4	Analyze	00	00	00
K5	Evaluate	00	00	00
K6	Create	00	00	00
Total Marks 100		20	20	60

Assessment table

Assessment Tool	K1	K2	K3
	CO1,CO2	CO3,CO4	CO5
ISE (30 Marks)	30	00	00
ISE III (10 Marks)	00	05	05
ESE Assessment (60 Marks)	20	30	10

Special Instructions if any: Nil

Designed By: - Dr.U.V.Hambire

Approved in XXVth Academic Council
Dated: 18th April 2023

MEPC3012: Internal Combustion Engines and Gas Turbines	
Teaching Scheme **Lectures:** 2hrs/Week **Tutorials:** 1hr/Week **Credits:**3	**Examination Scheme** **ISE I** : 15 Marks **ISE II** : 15Marks **ISE III** : 10Marks **End Semester Exam**: 60marks

Course description:
After completing this course, students will have abroad and fundamental understanding of Internal Combustion Engines. Topics range from an overview of IC Engines and its different types of combustion processing SI Engine, CI Engine normal combustion and abnormal combustion and performance evaluation of IC Engine heat balance sheet and learn the working of gas turbines and performance evaluation of gas turbine and method to improve efficiency of gas turbine In addition, students will learn common evaluation terminology, of IC Engine and gas turbine used and career options available within this field

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

CO1	Understand various types of I.C. Engines, Cycles of operation and Identify fuel metering, fuel supply systems for different types of engines.
CO2	Explain combustion phenomena in SI and CI engines and Analyzed the effect of various operating variables on engine performance.
CO3	Evaluate performance Analysis of IC Engine and Justify the suitability for different applications.
CO4	Explain the conventional and non-conventional fuels and effects of emission for of IC engines, its effects and the legislation standards.
CO5	Analyzed the performance of Gas Turbine.

Detailed Syllabus

Unit-1	**I.C. Engines -** Classification based on multi cylinder engine, firing order, selection criteria of IC engines based on application, materials and manufacturing processes of ICE components. **Fuel Supply systems of SI and CI engines** – Types of carburetor (makes), Fuel supply systems for C.I.engines :Requirement of ideal injection system, types of injection systems, fuel pump sand injectors, types of nozzles,
Unit-2	**Combustion in SI engines** – stages of combustion, ignition lag, engine variable affecting flame propagation, detonation, effects of detonation & its control, octane rating, combustion chamber design principle and types.
	Combustion in CI engines–stages, delay period and it's, variable, diesel knock and its control, octane rating of fuels, different types of combustion chambers. **Comparison of SI & CI engines** – For different thermodynamics and operating characteristics
Unit-3	**Testing and performance** – Review of IC engine testing, and trial calculation on testing at different load characteristics, Performance characteristics such as brake Thermal efficiency volumetric efficiency BSFC, Economical running, Williams line, interrelationship of various engines variables, performance graphs
Unit-4	**Exhaust Emission**–Introduction, constituents of exhaust gas, effects on human health and causes of formation and their measurement pollution control device and EURO standards. **Alternative fuels for IC engines** like LPG, CNG, Alcohols, Hydrogen etc., their need, properties, engine modification and performance

Unit-5	**Gas Turbine** – theory & fundamentals of gas turbine, principle, classification, Atkinson & Joule cycle, assumption for simple gas turbine, cycle analysis, work ratio concept to f maximum and optimum pressure ratio, effect to operating variables on thermal Efficiency, Regenerative, Inter cooling and reheating their effect on performance.

Text and Reference Books

1. HeywoodJ.B.,"InternalcombustionEngineFundamentals",McGrawHill,1988
2. Obert E.F., "Internal combustion Engine and Air Pollution", Intext Educational Pub,1974
3. Ganesan V., "Internal combustion Engines", 6 th Ed.Tata McGraw Hill Publishing Co.
4. Domkundwar V.M. "Internal Combustion Engines"-
5. Mathur M.C.,SharmaR.D.,"Internalcombustionengines",8th Ed.; Dhanpat Rai publication.,2003.
6. Pulkrabek W," Engineering Fundamentals of Internal Combustion Engine", Prentice Hall,1997

Mapping of Course outcome with program outcome

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

Assessment:

ISE I: Shall be on the basis of Class Tests/ Assignments/ Quizzes on First and Second unit.

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

ISE III: Shall be based on 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	ESE
K1	Remember	03	03	00	10
K2	Understand	05	05	05	10
K3	Apply	03	03	05	20
K4	Analyze	02	02	00	20
K5	Evaluate	03	03	00	00
K6	Create	00	00	00	00
Total Marks100		15	15	10	60

Approved in XXV th Academic Council
Dated: 18th April 2023

Assessment table

Assessment Tool	**K1 to K4**	**K1 to K4**	**K1 to K4**	**K1 to K4**	**K1 to K4**
	CO1	CO2	CO3	CO4	CO5
ISE I	05	03	02	05	00
ISE II	05	03	02	00	05
ISE III	03	01	01	03	02
ESE	10	10	10	20	10

Special Instructions if any: Nil

Designed by: Dr.S.D.Ambekar

Approved in XXVth Academic Council
Dated: 18th April 2023

MEPC3018: LAB Internal Combustion Engines and Gas Turbines	
Teaching Scheme **Practical :2hrs/week** **Credits :1**	**Examination Scheme** **ISE I : 25marks** **ESE : 25 Marks**

Course Outcomes:

CO1	Identify the various types of I.C. Engines and Cycles of operation.
CO2	Express the effect of various operating variables on engine performance
CO3	Demonstration of fuel metering and fuel supply systems for different types of engines
CO4	Analyze & Justify the suitability of conventional and non-conventional fuels for IC engines
CO5	Understand the effects of emission formation of IC engines, its effects and the legislation standards

Term work	
Term work shall consists of record of the following experiments	
1.	Trial on diesel engines for performance evaluation.
2.	Trial on petrol engines for performance evaluation.
3.	Morse test trial
4.	Assembling and disassembling of modern fuel supplying system
5.	Actual valve timing diagram of high/low speed engine
6.	Exhaust gas analysis of S.I./C.I.engines.
7.	Study of alternative fuel.
8.	Experiment and trail on VCR IC Engine

Mapping of Course outcome with program outcome

Course Out come	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**
CO1	**3**												**1**	
CO2		**2**												
CO3	**2**													2
CO4	**2**												**1**	
CO5						**2**	**3**						**1**	

Assessment:

ISE I: Shall be on the basis of assessment of term work.

ESE: ESE will based on oral exam conducted by course coordinator and external examination.

Assessment table

Assessment Tool	**S1**	**S2**	**S3**	**S2**	**S2**
	C01	C02	C03	CO4	CO5
ISE I	10	05	02	02	01

Approved in XXVth Academic Council
Dated: 18th April 2023

Assessment Pattern

Assessment Pattern Level No.	Knowledge Level	Term Work	Practical Examinations& Viva Voce
S1	Implementation	04	05
S2	Manipulation	07	10
S3	Precision	14	05
S4	Articulation	00	00
S5	Naturalization	00	00
Total Marks 50		25	25

Designed by: Dr.S.D.Ambekar

Approved in XXVth Academic Council
Dated: 18th April 2023

MEPE3013: POWER PLANT ENGINEERING	
Teaching Scheme **Lectures: 3Hrs/Week** **Credits: 3**	**Examination Scheme** **ISE I :15Marks** **ISE II :15Marks** **ISE III :10Marks** **End Semester Exam (ESE) :60Marks**

Course description:

After completion of the course, students will have understanding of different types of power plants, their construction and working. They will have knowledge of impact of various power plants on our environment. They will also have the knowledge of power generation economics and will be able to do the cost analysis of power plants.

Course Outcome

After completing the course students will be able to:

CO1	Analysed the economics of power generation.
CO2	Understand basics of steam turbine power plants.
CO3	Explain the working of power generation systems like hydraulic power, nuclear power
CO4	know the working of power generation systems like Diesel Engine and Gas Turbine power plants
CO5	Analysed of environmental impact of power plant and their remedies

Detailed Syllabus:

Unit 1	**Economics of Power Generation:** Type of loads, demand factor, load factor, diversity factor, utilization factor, plant capacity factor, and plant use factor. Load curves, load duration curves. (Numerical) Location of power plant, Layout of power plant building. Cost analysis: capital cost, operational cost, initial cost, interest, depreciation cost. Selection of type of power generation, selection of power plant equipment's, economics in plant selection, factors affecting economics of generation and distribution of power. Performance and operating characteristics of power plants, economic load sharing.

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Unit 2	**Steam Power Plants:** Classification, layout of a modern steam power plant, essential requirements of steam power station design, selection of site for steam power station, capacity of steam power plants, choice of steam conditions. Coal handling systems, fluidized bed combustion, CFBC, ash handling, dust collection, disposal and applications of fly ash, chimney draught. Classification of steam turbines, energy losses in steam turbines, governing and control. Super Critical Ultra Mega Power Plant
Unit 3	**Nuclear Power Plants:** Nuclear: Atomic structure, Nuclear reaction, Nuclear stability and energy of binding, radioactive decay and half-life, heat transfer and fluid flow in nuclear reactors, types of reactors, metals for nuclear energy, advantages of nuclear power plants, site selection, safety measures, India's nuclear power program;
Unit 4	**Diesel Engine and Gas Turbine Power Plants:** Diesel Engine Power Plant: application, advantages and disadvantages, typed of Diesel plants, Heavy Fuel Oil Engines based power plant, essential components of Diesel engine power plants. Gas Turbines Power Plant: applications, advantages and disadvantages, site selection, layout, classification, components of gas turbines plant, gas turbine fuels, Gas Turbine materials.
Unit 5	**Environmental Impact of Power Plant Operation:** Pollution from thermal power plants, Thermal pollution: sources, side effects, measurement, control. Air pollution: sources, effects on health, effects on material, gaseous emission and its control, particulate emission and its control, greenhouse effect, acid rain, acid snow, photochemical smog, dry acidic deposition, flue gas desulfurization system. Pollution from nuclear power plants: nuclear power and environment, storage and disposal of radioactive waste. Introduction to pollution control norms (refer to CPCB and SPCB websites)

Text Books

1. P. K. Nag, “Power Plant Engineering”, Tata McGraw Hill
2. S. M. Khopkar, “Environmental Pollution: Monitoring and Control”, New Age International Publishers
3. Arora and Domkundwar, “A Course in Power Plant Engineering”, Dhanpat Rai & Co., Delhi

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Reference Books

1. M. M. Wakil, "Power Plant Technology", Tata McGraw Hill
2. R. K. Rajput, "Power Plant Engineering", Laxmi Publication (P) Ltd.
3. Dr. B. B. Parulekar, "Energy Technology", Khanna Publishers, Delhi
4. A. k. Raja, "Power Plant Engineering", New Age International Publishers, Delhi

Mapping of Course outcome with Program Outcomes

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

– – **3 High 2 Medium 1-Low**

Assessment:

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

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

ISE III: Shall be based on 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	05	00	00	12
K2	Understand	05	05	05	18
K3	Apply	05	05	05	18
K4	Analyze	00	05	00	12
Total Marks100		15	15	10	60

Assessment Table

Assessment Tool	K1	K2	K3	K4
	C01/CO5	C02/CO3/CO4	C01/CO5	CO1
ISE I (15 marks)	05	05	05	
ISE II (15 marks)		05	05	05
ISE III (15 marks)		05	05	
ESE Assessment (60Marks)	12	18	18	12

Special Instructions if any: Nil

Designed by: Mr.K.S.Wasankar

Approved in XXVth Academic Council
Dated: 18th April 2023

MEPE3019: Lab- Power Plant Engineering	
Teaching Scheme **Practical : 2 Hrs/Week** **Credits : 1**	**Examination Scheme** **ISE I : 25 Marks** **ESE : 25 Marks**

Course Outcome

As an outcome of completing the Laboratory course, students will able to

CO1	Understand the working of Steam and Gas Turbine Power Plant
CO2	Explain the working of Diesel Engine, Nuclear and Hydro-electric Power Plant
CO3	Apply practical and relevant knowledge related to various Power Plant

List of Experiments

Sr. No.	Details
1	To study Modern Steam Power Plant.
2	To study Gas Turbine Power Plants
3	To study Diesel Engine Power Plants
4	To study Nuclear Power Plants.
5	To study Hydro-electric Power Plants.
6	Industrial visit to Solar PV Power Plant
7	Industrial visit to Hydroelectric / Thermal / Diesel Engine Power Plant

Assessment

ISE I The term work 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.

ESE : The Practical Examination will comprise of performing the experiment and OR viva voce on the syllabus. The practical will be assessed by two examiners; one will be the course coordinator and other will be examiner appointed by BOS.

Mapping of Course outcome with Program 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	3		3	3	2		1	2		2	2	
CO2	1	2	3		3	3	2		1	2		2		1
CO3	1	1	2	3		3	3		3	3	2	2	1	

1 – High 2 – Medium 3 – Low

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Dated: 18th April 2023

Assessment:
ISE I: Shall be on the basis of assessment of term work.
ESE: ESE will based on oral exam conducted by course coordinator and external examination.

Assessment Pattern

Assessment Pattern Level No.	Skill Level	ISE I	ESE
S1	Imitation	5	5
S2	Manipulation	10	10
S3	Precision	10	10
Total		25	25

Assessment Table

Assessment Tool	S1	S2	S3
	CO1	CO2	CO3
ISE I (25 Marks)	15	10	

Designed by: Mr.K.S.Wasankar

Approved in XXVth Academic Council
Dated: 18th April 2023

MEPC3014: Machine Design -II		
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: This course provides the knowledge of machine design. Course includes Design of Clutches, Design of Gears, Design of bearing & pressure vessels etc...

Course Outcomes:

After completing the course, students will be able to:

CO1	Understand the working principal and design of bearings.
CO2	Explain the knowledge to design of spur gears and helical gears
CO3	Apply knowledge to design of bevel gears and worm gears
CO4	Study aesthetic and ergonomics consideration in design
CO5	Analyzed the statistical consideration in design of machine elements

Detailed Syllabus:

Unit 1	**Sliding contact bearings** :Working principle of hydrodynamic and hydrostatic bearing, Design of hydrodynamic and hydrostatic bearings **Rolling contact bearings**: Classification, static and dynamic load carrying capacity, load-life relationship, selection from manufacture's catalogue, comparison of sliding contact and rolling contact bearings.
Unit 2	**Design of spur and helical gears**: Design of spur gear: Terminology, Force analysis, Gear tooth failures. Design of helical gear: Terminology, Virtual number of teeth, force analysis
Unit 3	**Design of Bevel gears and Worm gears**: Terminology, Force analysis, beam strength of bevel gears, Wear strength of bevel gears, and effective load on gear tooth **Design of worm gears**: Terminology, Force and efficiency analysis, Bending and surface fatigue strength, Worm gear thermal considerations, Methods of lubrications.
Unit 4	**Aesthetic and Ergonomic considerations** in Design Aesthetic considerations- Basic type of product form, design features like shape, colour, materials and finishes, quality etc. Ergonomic considerations- Man-Machine closed loop system, design of display panels, design of controls etc
Unit 5	**Statistical consideration in design** Frequency distribution-Histogram and Frequency polygon – Normal distribution. Standard variable – population combinations.

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Text and Reference Books

[1] Shigley J.E. and Mischke C.R., "Mechanical Engineering Design", Tata McGraw Hill Publication Co. Ltd.
[2] Spotts M.F. and Shoup T.E. , "Design of Machine Elements", Prentice Hall International.
[3] Bhandari V.B., "Design of Machine Elements", Tata McGraw Hill Publication Co. Ltd.
[4] FArzdak Haideri, "Machine Desig", Nirali Prakashan, Pune.
[5] Willium C. Orthwein, "Machine Components Design", West Publishing Co. and Jaico Publications House.
[6] Design Data", P.S.G. College of Technology, Coimbatore. B. Cheatham, Mechanical Analysis and Design, 2 nd Ed., Prentice Hall

Mapping of Course outcome with Program Outcomes and Program Outcomes

3 – High 2 – Medium 1 – Low

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

Assessment Pattern:

Assessment Pattern LevelNo.	**KnowledgeLevel**	**ISE I**	**ISE II**	**ISE III**	**End Semester Examination**
K1	Remember	5	5		
K2	Understand	5	5		12
K3	Apply	5	5	5	24
K4	Analyze			5	12
K5	Evaluate				
K6	Create				12
Total Marks 100		15	15	10	60

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Assessment table:

Assessment Tool	**K2.K3**	**K2,K3**	**K3**	**K4**	**K3,K4**
	CO1	CO2	CO3,CO4	CO4	CO5
ISE I (15 Marks)	7	8			
ISE II (15 Marks)		5	5	5	
ISE III (10 Marks)			5	5	
	K2 to K4,K6	**K2 to K4,K6**	**K2 to K4,K6**	**K2 to K4,K6**	**K2 to K4,K6**
ESE Assessment (60 Marks)	12	12	12	12	12
Total Marks 100	19	25	22	22	12

Special Instructions if any: Nil

Designed by: Mr.Sachin Chaudhari

Approved in XXVth Academic Council
Dated: 18th April 2023

MEPC3020 : Lab Machine Design-II		
Teaching Scheme	**Examination Scheme**	
Practical: 02 hrs/ week	**ISE I**	**25 Marks**
	ISE II	**-**
Credits:01	**ISEIII**	**-**
	ESE	**25 Marks**

Course description:

The course aims at imparting knowledge of Machine Design procedure for different elements.

Course Outcomes:

After completing the course, students will be able to:

CO1	Approach a design problem involving a complete mechanical system, successfully, taking decisions when there is not a unique answer.
CO2	design and prepare part and assembly drawings
CO3	develop industrial drawing with conventions

Detailed Syllabus:

Part I	Term work shall consist of term work shall consist of "TWO" design projects. Each project shall consist of two imperial size sheets – one involving assembly drawing with a parts list and overall dimensions and the other sheet involving detailed drawings of individual components. Manufacturing tolerances, surface finish symbols and geometric tolerances should be specified so as to make it a working drawing. 2. Design projects should include selection of prime mover and design of mechanical systems comprising of machine elements: Design data book shall be used extensively for the selection of the components.
Part II	Total five assignments (One on each unit - only Numerical)

Assessment:

ISE I: Shall be on the basis of assessment of term work.

ESE : ESE will based on oral exam conducted by course coordinator and external examination.

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes3 – High 2 – Medium 1 - Low

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

Assessment Pattern:

Assessment Pattern LevelNo.	**Knowledge Level**	**ISE I**
S1	Imitation	5
S2	Manipulation	10
S3	Precision	10
S4	Articulation	
S5	Naturalization	
S6		
Total Marks 50		25

Assessment table:

Assessment Tool	**S1 to S3**	**S1,S2**	**S1**
	CO1	CO2	CO3
ISE I (15 Marks)	15	10	
Total Marks 50	30	15	5

Special Instructions if any: Nil

Designed by: Mr.Sachin Chaudhari

Approved in XXVth Academic Council
Dated: 18th April 2023

MEPC3015: HEAT AND MASS TRANSFER		
Teaching Scheme	**Examination Scheme**	
Lectures: 02 hrs / week	**ISE I**	15 Marks
Tutorial: 01 hrs / week	**ISE II**	15 Marks
Credits: 03	**ISE III**	10 Marks
	End Semester Examination	60 Marks

Course description: This course introduces undergraduate students to Heat Transfer. The background required includes a sound knowledge of Mathematics, Engineering Thermodynamics, Applied thermodynamics and Fluid Mechanics of second year Level. The course aims at imparting knowledge of Heat Transfer and mass Transfer.

Course Outcomes:

After completing the course, student should be able to:

1. Understand the basic modes of heat transfer.
2. Compute temperature distribution in steady - state and unsteady, state heat conduction.
3. Analyzed heat transfer through extended surfaces.
4. Interpret forced and free convection heat transfer.
5. Explain the principles of radiation heat transfer
6. Design heat exchangers using LMTD and NTU methods.

Detailed Syllabus:

Heat Conduction

Concepts and Mechanism of heat flow: Steady and unsteady state heat transfer, Modes of heat transfer, their physical mechanism. Laws of heat transfer, thermal conductivity, heat transfer coefficient, radiation heat transfer coefficient. Isotropic and an-isotropic materials, Insulation materials, Thermal resistance and thermal conductance. Generalized one dimensional heat conduction equation and reduction to Fourier, Poisson and Laplace equations, Boundary conditions, Steady state heat conduction with and without heat generation in plane wall, cylinder and sphere, electrical analogy, Thermal contact resistance, composite system, critical thickness of insulation on cylindrical bodies, illustrative examples.

Unsteady State Heat Conduction and Fins

Lumped heat capacity system, Biot number, unsteady state heat transfer for lumped capacity system, Extended Surface: Types of fins, governing equation for pin fin for infinite long fin and fin with negligible heat loss, Fin performance, fin efficiency, fin effectiveness, overall fin effectiveness, approximate solution of fins. Error in temperature measurement by thermometer.

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Convection Heat Transfer

Principle of heat convection: mechanism, natural and forced convection. Thermal boundary layer, heat transfer in flow through pipe, entry length, heat transfer in high speed flow, free and forced convection over vertical / horizontal plate, pipe/cylinder and sphere using empirical relations only, Principle of condensation and boiling (No numerical treatment).

Radiation Heat Transfer

Thermal radiation: Concept, Black body radiation, Spectral and total emissive power, Stefan Boltzmann law, Radiation laws. Irradiation and radiosity, Surface absorption, reflection and transmission, emissivity. Radiation view factor, Properties of view factor, (No numerical treatment on view factor), radiation heat exchange between two diffuse gray surface, radiation shield.

Heat Exchangers and Mass Transfer

Classification of heat exchangers, temperature distribution in parallel, counter flow arrangement, condenser and evaporator, Overall heat transfer coefficient, fouling factor. Log-mean temperature difference method and NTU – effectiveness method of analysis for rating and sizing of heat exchangers. Requirement of good heat exchanger and heat exchanger and design and selection, practical applications, heat pipe. Introduction to Mass transfer, Fick's law, dimensionless numbers: Sherwood, Schmidt, Peclet, Rayleigh

Text Books:

1 Heat and Mass Transfer, R.K.Rajput, S.Chand & Company Ltd, New Delhi

2 Engineering Heat and Mass Transfer, M. M. Rathore 2nd Edition, Laxmi Publications, New Delhi.

Reference Books:

1. Heat Transfer, J.P.Holman ,VII Edition, Mc Graw Hill, 1992
2. Heat and Mass Transfer, R.K.Rajput, Revised edition 2012, S.Chand & Company Ltd, New Delhi.
3. Heat and Mass Transfer, D.S.Kumar, D.S.Kumar , 8th edition 2010,S.K.Kataria & Sons, Delhi
4. Heat Transfer, P.K.Nag, 3rd edition 2011Tata McGraw Hill Publishing Company Ltd, New Delhi.
5. A Text Book on Heat Transfer,Sukhatme S.P, III rd Edition ,Orient Longmans Ltd, New Delhi, 1989.
6. A Course in Heat and Mass Transfer, Arora S.C. & Domkundwar, IVth Edition, Dhanpat Rai & Sons, 1994.
7. Heat Transfer –A Practical Approach, Yunus A. Cengel,2nd edition 2002, Tata McGraw Hill

Approved in XXVth Academic Council
Dated: 18th April 2023

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	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS01	PSO2
CO1	1	2											1	1
CO2	1	2	2										1	
CO3		3	2										2	2
CO4	2	3	2										1	
CO5	1	2	3										2	3
CO6	2	2	3										1	

Assessment Pattern:

Assessment Pattern Level	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	2	2	2	
K2	Understand	3	3	3	
K3	Apply	2	2	3	
K4	Analyze	3	3	2	
K5	Evaluate	5	5		
K6	Create				
Total Marks 100		15	15	10	60

Assessment table:

Assessment Tool	K1 and K2	K2 and K3	K4 and K5	K1 and K2	K2 and K3	K4 and K5
	CO1	CO2	CO3	CO4	CO5	CO6
ISE I (15 Marks)	4	6	5			
ISE II (15 Marks)				4	6	5
ISEIII (10 Marks)	1	2	2	1	2	2
ESE Assessment (60 Marks)	05	10	15	05	10	15
Total Marks 100	10	18	22	10	18	22
Designed by: Dr.U.N.Shete						

Approved in XXVth Academic Council
Dated: 18th April 2023

MEPC3021- LAB HEAT TRANSFER		
Teaching Scheme	**Examination Scheme**	
Practical: 2 Hrs/Week	ISE I	25 Marks
Credits: 1	ESE	25 Marks

Course Outcome

As an outcome of completing the Laboratory course, students will able to:

1. Understand the basic laws of heat transfer, the fundamentals of convective heat transfer process.
2. Analyze problems involving steady state heat conduction in simple geometries, performance of pin fin under different tip conditions, Stefan's Boltzmann constant, emissivity of test surface, critical heat flux.
3. Develop solutions for transient heat conduction in simple geometries, heat exchanger performance by using the method of log mean temperature difference.
4. Calculate radiation heat transfer between black body surfaces, radiation heat exchange between gray body surfaces.

DETAIL SYLLABUS

Minimum Eight experiments shall be performed to cover entire curriculum of course List of Experiments

1. Determination of thermal conductivity of metal rod.

2. Determination of thermal conductivity of insulating powder.

3. Determination of thermal conductivity of composite wall.

4. Determination of heat transfer coefficient in natural convection

5. Determination of heat transfer coefficient in forced convection.

6. Determination of temperature distribution ,fin efficiency in natural and forced convection

7. Determination of emissivity of a test surface.

8. Determination of Stefan Boltzmann constant

9. Study of pool boiling phenomenon and determination of critical heat flux

10 Determination of LMTD, overall heat transfer coefficient and effectiveness of heat exchanger in parallel and counter flow arrangement.

11 Determination of heat transfer from a heat pipe.

12. Calibration of thermocouple.

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Dated: 18th April 2023

ASSESMENT

ISE I

The term work 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

ESE

The Practical Examination will comprise of performing the experiment and viva voce on the syllabus

The practical will be assessed by two examiners, one will be the course coordinator and other will be examiner appointed by BOS

Mapping of Course outcome with Program Outcomes and Program

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	PS01	PSO2
CO1	**1**	**2**											**1**	
CO2		1	**2**	**2**									**1**	**2**
CO3		**1**	**2**	**3**									**2**	
CO4		**1**	**2**	**3**									**2**	**1**

Assessment Pattern:

Assessment Pattern LevelNo.	Knowledge Level	ISE I
S1	Imitation	5
S2	Manipulation	10
S3	Precision	10
S4	Articulation	
S5	Naturalization	
S6		
Total Marks 50		25

Assessment table:

Assessment Tool	S1 to S3	S1,S2	S1
	CO1	CO2	CO3
ISE I (15 Marks)	15	10	
Total Marks 50	30	15	5

Designed by: Dr.U.N.Shete

Approved in XXVth Academic Council
Dated: 18th April 2023

MEPE3016: TRIBOLOGY		
Teaching Scheme	**Examination Scheme**	
Lectures: 03 hrs./ week	**ISE I**	**15 Marks**
Tutorial: 00 hrs./ week	**ISE II**	**15 Marks**
Credits: 02	**ISE III**	**10 Marks**
	End Semester Examination	**60 Marks**

Course description: Design of surfaces in contact is a critical problem for mechanical engineering. This course addresses the design of tribological systems: the interfaces between two or more bodies in relative motion. Fundamental topics include: friction, wear, wear mechanism, wear model, hydrodynamic, hydrostatic and gas lubrication.

Course Outcomes:

After completing the course, students will be able to:

CO1	Understand about lubricants and its properties
CO2	Provide a clear view on types of wears, sources of frictions and lubrication systems To accustom with hydrodynamic lubrication
CO3	Apply fundamental principles of hydrodynamic lubrication
CO4	Explain fundamental principles of hydrostatic lubrication
CO5	Understand the gas lubrication used in industry

Detailed Syllabus:

Unit 1	**Introduction to Tribology**, tribology in design, tribology in industry, Lubricants - Properties-physical and chemical, Types of additives, extreme pressure lubricants, Lubrication-introduction, basic modes of lubrication, Tribology of sliding contact bearings and Rolling contact bearings
Unit 2	**Wear, Friction and Lubrication**: Wear: Mechanism, Wear classification – adhesive, abrasive, fatigue wear, Fretting wear of unlubricated metal. Friction: Sources of friction, static and kinematics coefficient of friction, effect of different additives on coefficient of friction. Lubrication: Types of lubricants, lubricant coating, lubrication mechanism, squeeze film, hydrodynamic, elasto-hydrodynamic lubrication, **Gas Lubrication**: Introduction, Reynolds equation for gas lubrication, self-acting gas bearing, Merits and demerits of gas lubrication, Applications
Unit 3	**Hydrodynamic Lubrication**: Introduction, Solution of Generalized Reynold's equation, Infinitely long journal bearing, Infinitely short journal bearing, thrust bearing, Sommerfeld number, Raimondi and Boyd method. **Hydrostatic Lubrication**: Basic concept, advantages and limitations, Viscous flow through rectangular slot, Load carrying capacity and flow requirement of hydrostatic step bearing, energy losses (Numerical Treatment).

Text and Reference Books

1. A Text Book of "Tribology" by Hg Phakatkar, Rr Ghorpade, 2nd revised edition, Nirali Prakashan, Pune, Aug2011.
2. A Text Book of "Tribology" by R.B.Patil, 1st edition, Tech-Max Publications, Pune, Aug2009
3. A Text Book of "Introduction to Tribology" by Bharat Bhushan, 2nd Edition, John Wiley and Sons Publication, NY,2013.
4. A Text book of "Design of Machine Elements by V.B.Bhandari, 4th edition, Tata-McGraw Hill Publication Co. Ltd., Aug2016

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Mapping of Course outcome with Program Outcomes and Program Outcomes

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

3 – High 2 – Medium 1 – Low

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.

Assessment Pattern:

Assessment Pattern LevelNo.	**KnowledgeLevel**	**ISE I**	**ISE II**	**ISE III**	**End Semester Examination**
K1	Remember	5	5		
K2	Understand	5	5		12
K3	Apply	5	5	5	24
K4	Analyze			5	12
K5	Evaluate				
K6	Create				12
Total Marks 100		15	15	10	60

Assessment table:

Assessment Tool	**K2.K3**	**K2,K3**	**K3**	**K4**	**K3,K4**
	CO1	CO2	CO3,CO4	CO4	CO5
ISE I (15 Marks)	7	8			
ISE II (15 Marks)		5	5	5	
ISE III (10 Marks)			5	5	
	K2 to K4,K6	**K2 to K4,K6**	**K2 to K4,K6**	**K2 to K4,K6**	**K2 to K4,K6**
ESE Assessment (60 Marks)	12	12	12	12	12
Total Marks 100	19	25	22	22	12

Special Instructions if any: Nil **Designed by: Mr.Sachin Chaudhari**

Approved in XXVth Academic Council
Dated: 18th April 2023

MEPE3022 : LAB TRIBOLOGY		
Teaching Scheme	**Examination Scheme**	
Practical: 02 hrs/ week	**ISE I**	**25 Marks**
	ISE II	**-**
Credits:01	**ISEIII**	**-**
	ESE	**25 Marks**

Course Description:

The course aim of imparting the knowledge of Tribology. Main focus of the course is to understand the tribological concept by hands-on experiment, bearing design and its application, lubrication practices, friction and wear.

Course Outcomes:

After completing the course, students will be able to:

CO1	Study of journal bearing apparatus, thrust bearing.
CO2	Apply of the friction/lubrication mechanisms and know how to apply them to the practical engineering problem through brake line test rig
CO3	Calculate wear ratio and wear measurement through pin on disc test rig

Detailed Syllabus:

Part I	**Content** **Minimum five experiments and three assignments shall be performed to cover entire curriculum of course** **Study/Demonstration on Journal Bearing apparatus.** 1. Study/Demonstration on tilting pad thrust bearing apparatus. 2. Study/Demonstration on Brake line friction test rig. 3. Measurement of wear and coefficient of friction using Pin on Disk. 4. Friction in Journal Bearing. 5. Simulation and Modelling of Tribo Pairs
Part II	03 assignments include in the course based on curriculum of this course.

Assessment:

ISE I: Shall be on the basis of assessment of term work.

ESE : ESE will based on oral exam conducted by course coordinator and external examination.

Approved in XXVth Academic Council
Dated: 18th April 2023

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

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

3 – High 2 – Medium 1 - Low

Assessment Pattern:

Assessment Pattern LevelNo.	**Knowledge Level**	**ISE I**
S1	Imitation	5
S2	Manipulation	10
S3	Precision	10
S4	Articulation	
S5	Naturalization	
S6		
Total Marks 50		25

Assessment table:

Assessment Tool	**S1 to S3**	**S1,S2**	**S1**
	CO1	CO2	CO3
ISE I (15 Marks)	15	10	
ESE (60 Marks)	15	5	5
Total Marks 50	30	15	5

Special Instructions if any: Nil

Designed by: Mr.Sachin Chaudhari

Approved in XXVth Academic Council
Dated: 18th April 2023

MEPE3017 : Advanced Manufacturing Technology		
Teaching Scheme	**Examination Scheme**	
Lectures: 03 hrs./ week	**ISE I**	**15 Marks**
Tutorial: 00 hrs./ week	**ISE II**	**15 Marks**
Credits: 02	**ISE III**	**10 Marks**
	End Semester Examination	**60 Marks**

Course Discerption:

Students will have a broad and fundamental understanding of Advanced Manufacturing Techniques. Topics range from an advanced casting, advanced micro machining, Laser beam machining, powder metallurgy and Advanced measuring techniques like CMM etc. Students will learn Advanced manufacturing technique knowledge and tools used in it, and career options available within this field..

Course Outcomes:

After completing the course, students will be able to:

CO1	Understand the knowledge of different advanced manufacturing technique.
CO2	Identify different micro-machining processes and devices used for AMT.
CO3	Evaluate different aspects of micro-machining.
CO4	Explain about powder metallurgy and surface coating.
CO5	Know about basic concepts of Composites

Detailed Syllabus:

Unit 1	**Advances in Casting Process:** V-process, flask less moulding, evaporative casting, plaster mould casting, design for plaster mould casting quality accuracy, uniformity and other considerations in casting and moulding. Recent developments in pattern and casting designing, **Powder Metallurgy:** process, different methods of producing powders, pressing, extruding, sintering, and hot pressing,
Unit 2	**Fabrication of Micro Devices:** Crystal growth and wafer preparation, Film Deposition oxidation, lithography, bonding and packaging, reliability and yield, Printed Circuit boards, computer aided design in microelectronics, surface mount technology, Integrated circuit economics. E-Manufacturing, nanotechnology
Unit 3	**Surface Coating and Processing of Composites:** **Surface Coating**: Scope, Cleaners, Methods of cleaning, Surface coating types, and ceramic and organic methods of coating, economics of coating. **Processing of Composites** Composite Layers, Manufacturing of Particulate and fibre reinforced composites, Elastomers, Reinforced plastics, MMC, CMC, Polymer matrix composites.

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Text and Reference Books

1. Modern Manufacturing process engineering, Benjamin W. Niebel, Allen B Draper, Richard A. Wysk, 2nd edition, McGraw Hill, New Delhi, 2001.
2. Non Traditional Manufacturing Processes, Garry F. Benedict- Marcel Dekker, by CRC Press New York.2014.
3. Production Technology, HMT,Hand Book",TMH.
4. Metal Casting, Hayane and Rosanthal, Indian edition, McGraw Hill, New delhi, 2001.
5. Non-traditional manufacturing process, Derban Michigan, 5th edition, E.J. Weller Society of Manufacturing Engineers, 2012.

Mapping of Course outcome with Program Outcomes and Program Outcomes

3 – High 2 – Medium 1 – Low

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

Assessment Pattern:

Assessment Pattern LevelNo.	KnowledgeLevel	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	5	5		
K2	Understand	5	5		12
K3	Apply	5	5	5	24
K4	Analyze			5	12
K5	Evaluate				
K6	Create				12
Total Marks 100		15	15	10	60

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Assessment table:

Assessment Tool	**K2.K3**	**K2,K3**	**K3**	**K4**	**K3,K4**
	CO1	CO2	CO3,CO4	CO4	CO5
ISE I (15 Marks)	7	8			
ISE II (15 Marks)		5	5	5	
ISE III (10 Marks)			5	5	
	K2 to K4,K6	**K2 to K4,K6**	**K2 to K4,K6**	**K2 to K4,K6**	**K2 to K4,K6**
ESE Assessment (60 Marks)	12	12	12	12	12
Total Marks 100	19	25	22	22	12

Special Instructions if any: Nil

Designed by: Mr.Sachin Chaudhari

Approved in XXVth Academic Council
Dated: 18th April 2023

MEPE3023 : Lab Advanced Manufacturing Technology		
Teaching Scheme	**Examination Scheme**	
Practical: 02 hrs/ week	**ISE I**	**25 Marks**
	ISE II	**-**
Credits:01	**ISEIII**	**-**
	ESE	**25 Marks**

Course Description:

The course aim of imparting the knowledge of topics range from an advanced casting, Advanced micro machining, Laser beam machining, powder metallurgy and Advanced measuring techniques like CMM etc. Students will learn Advanced manufacturing technique knowledge and tools used in it

Course Outcomes:

After completing the course, students will be able to:

CO1	Understand various advanced casting processes, micro machining, rapid prototyping etc.
CO2	Study of different aspects of powder metallurgy and surface coating
CO3	Program a CNC turning or milling machine for preparing a job.

Detailed Syllabus:

Minimum five experiments and three assignments shall be performed to cover entire curriculum of course ME402UD.

List of experiments:

1. Study of various advanced casting processes, casting simulation and analysis.
2. Study of various micro-machining methods and devices.
3. Study the measurement system for micro-machining and understand it's inspection methods.
4. Study different aspects of powder metallurgy and surface coating.
5. Study, manipulate and control machining parameters for various manufacturing processes used in industry.
6. Study hardness measurement of mild steel specimen, applying various heat treatment processes.
7. Study rapid prototyping and generative manufacturing processes.
8. Study of geometry of robot manipulator, actuators and grippers.
9. Programming on CNC Turning.
10. Programming on CNC Milling Machine.

03 assignments include in the course based on curriculum of this course.

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Dated: 18th April 2023

Assessment:
ISE I: Shall be on the basis of assessment of term work.
ESE: ESE will based on oral exam conducted by course coordinator and external examination.

Mapping of Course outcome with Program Outcomes and 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
CO1		2											3	
CO2			2		1					1				1
CO3	1	3												

Assessment Pattern:

Assessment Pattern LevelNo.	**Knowledge Level**	**ISE I**
S1	Imitation	5
S2	Manipulation	10
S3	Precision	10
S4	Articulation	
S5	Naturalization	
S6		
Total Marks 50		25

Assessment table:

Assessment Tool	**S1 to S3**	**S1,S2**	**S1**
	CO1	CO2	CO3
ISE I (15 Marks)	15	10	
Total Marks 50	30	15	5

Special Instructions if any: Nil

Designed by: Mr.Sachin Chaudhari

Approved in XXVth Academic Council
Dated: 18th April 2023

MEPR3024 : Lab- Computer Applications In Mechanical Engineering Project		
Teaching Scheme	**Examination Scheme**	
Practical: 02 hrs/ week	**ISE I**	**25 Marks**
	ISE II	**-**
Credits:03	**ISEIII**	**-**
	ESE	**25 Marks**

Course description:
The course aims at imparting knowledge of use CAD/CAM Software for different design and create different mechanical elements.

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

CO1	Acquire practical knowledge of 3D modeling software and create a model
CO2	Create and edit 2D drawing in 3D modeling software
CO3	Construct assemblies from the concepts learnt using 3D modeling software

Detailed Syllabus:

Unit 1	Perform following Practical on any **3 D modeling Software** platform Introduction Strengths and weaknesses of conventional 2D drawing. Types of geometric modeling, wire frame modeling, surface modeling, and solid modeling.
Unit 2	**Sketching,** line, circle, arc, spline. Connect two elements using an arc or a spline. Filleting, trimming. Dimensioning linear, angular, diameter, radius, modifying dimension. Constraints parallel, perpendicular, co-incident, vertical, horizontal, tangent, symmetric. Edit and modify sketches (Two assignment on sketching)
Unit 3	**Solid Modeling** Sketch based features extrude, revolve, sweep, variable section sweep, loft. Add, subtract, intersection. Use of part library threads, tapped holes, ribs, nuts, bolts etc. Datum planes, points, curves etc. parent child relationship. Modifying commands fillet, chamfer, array, copy, mirror etc. (Two assignment on Solid Modeling)
Unit 4	**Assembly and drafting** Assembly top down and bottom up approach, constraints, mate, align, Joints, Detailing generating views, sectional views, Orthographic views, isometric Dimensioning views, adding dimensional and geometric tolerances, surface finish. Creating BOM. (Two assemblies of machine component like knuckle joint, coupling, gate valve, stop valve Bench vice, tool post and Detailing of any one assembly and parts made in assignment)

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Dated: 18th April 2023

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes3 – High 2 – Medium 1 - Low

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

Assessment:
ISE I: Shall be on the basis of assessment of term work.
ESE : ESE will based on oral exam conducted by course coordinator and external examination.

Assessment Pattern:

Assessment Pattern LevelNo.	**Knowledge Level**	**ISE I**
S1	Imitation	5
S2	Manipulation	10
S3	Precision	10
S4	Articulation	
S5	Naturalization	
S6		
Total Marks 50		25

Assessment table:

Assessment Tool	**S1 to S3**	**S1,S2**	**S1**
	CO1	CO2	CO3
ISE I (15 Marks)	15	10	
Total Marks 50	30	15	5

Special Instructions if any: Nil

Designed by: Prof.Sayali Kulkarni

Approved in XXVth Academic Council
Dated: 18th April 2023