Government College of Engineering Aurangabad, Chhatrapati Sambhajinagar

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Curriculum for Second Year B. Tech. in Mechanical Engineering with One Multidisciplinary Minor Degree (NEP Compliant)

(With Effect from Academic Year 2024-25)

Approved in XXV IIIth Academic Council
Dated: 25th Jun 2024

Total Credits for the completion of B. Tech. (Mechanical Engineering) with Minor for Direct Second Year admitted students:

The total number of credits proposed for the B. Tech with 1 Multidisciplinary minor (Compulsory) degree is **128** as per the structure given below**:**

Semester		**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**Total Credits**
Programme Core Course (PCC)	Program Courses	**09+ 2***	**07**	**13**	**11**	**08**	**-**	**50**
Programme Elective Course (PEC)		**-**	**-**	**04**	**06**	**10**	**-**	**20**
Multidisciplinary Minor (MD M)	Multidisciplinary Courses	**04**	**03**	**04**	**03**	**-**	**-**	**14**
Open Elective (OE) Other than a particular program		**03**	**03**	**02**	**-**	**-**	**-**	**08**
Vocational and Skill Enhancement Course (VSEC)	Skill Courses	**-**	**02**	**-**	**02**	**-**	**-**	**04**
Ability Enhancement Course (AEC -01, AEC-02)	Humanities Social Science and Management (HSSM)	**-**	**02**	**-**	**-**	**-**	**-**	**02**
Entrepreneurship/Economics/ Management Courses		**02**	**02**	**-**	**-**	**-**	**-**	**04**
Indian Knowledge System (IKS)		**-**	**-**	**-**	**-**	**-**	**-**	**-**
Value Education Course (VEC)		**02**	**02**	**-**	**-**	**-**	**-**	**04**
Research Methodology	Experiential Learning Courses	**-**	**-**	**-**	**-**	**-**	**04**	**04**
Comm. Engg. Project (CEP)/Field Project (FP)		**02**	**-**	**-**	**-**	**-**	**-**	**02**
Project		**-**	**-**	**-**	**-**	**04**	**-**	**04**
Internship/ OJT		**-**	**-**	**-**	**-**	**-**	**12**	**12**
Co-curricular Courses (CC)	Liberal Learning Courses	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Total Credits (Major)		**22+ 2***	**21**	**23**	**22**	**22**	**16**	**128**

∗ This course is a 02 credit Program core course offered as Bridge course for DSY Students which is offered to regular UG students in 2nd semester. Programs can offer necessary courses as audit courses as required

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Teaching and Evaluation Scheme from Academic Year 2024-25 as per NEP - 2020
Second Year B. Tech. Program in Mechanical Engineering

Semester – III

Sr. No	Category	Course Code	Course Title	Teaching Scheme			Credits	Continuous Evaluation in terms of Marks				
				L	T	P		ISE I	ISE II	ISE III	ESE	Total
1.	PCC	MEPCC 2001	Machine Drawing	3	0	0	**3**	15	15	10	60	**100**
2.	PCC	MEPCC 2002	Machine Drawing Lab	0	0	2	**1**	-	-	-	25	**25**
3.	PCC	MEPCC 2003	Manufacturing Processes	2	0	0	**2**	10	10	-	30	**50**
4.	PCC	MEPCC 2005	Engineering Thermodynamics	2	0	0	**2**	10	10	-	30	**50**
5.	PCC	MEPCC 2006	Engineering Thermodynamics Lab	0	0	2	**1**	-	-	-	25	**25**
6.	MD M		Multidisciplinary Minor	3	0	0	**3**	15	15	10	60	**100**
7.	MD M		Multidisciplinary Minor Lab	0	0	2	**1**	-	-	-	25	**25**
8.	OE		Open Elective-I	3	0	0	**3**	15	15	10	60	**100**
9.	HSSM	MEEEM 2010	Industrial Engineering	2	0	0	**2**	10	10	-	30	**50**
10.	VEC	CEVEC 0010	Environmental Science	2	0	0	**2**	10	10	-	30	**50**
11.	FP / CEP	MECEP 2001	Mini Project	0	0	4	**2**	-	-	25	25	**50**
Total				**17**	**0**	**10**	**22**	**85**	**85**	**55**	**400**	**625**

MDM (Offered by Mechanical Department)

MEMDM5001 Photovoltaic Energy System
MEMDM5002 Photovoltaic Energy System Lab
MEMDM6001 Metrology and Quality Control
MEMDM6002 Metrology and Quality Control Lab

Open Elective – I (Offered by Mechanical Department)

MEOEC2010 Industrial Psychology /
MEOEC2011 Engineering Economics /
MEOEC2012 Ethical Values

Semester – IV

Sr. No	Category	Course Code	Course Title	Teaching Scheme			Credits	Continuous Evaluation in terms of Marks				
				L	T	P		ISE I	ISE II	ISE III	ESE	Total
1.	PCC	MEPCC 2007	Material Science and Metallurgy	3	0	0	**3**	15	15	10	60	**100**
2.	PCC	MEPCC 2008	Material Science and Metallurgy Lab	0	0	2	**1**	-	-	-	25	**25**
3.	PCC	MEPCC 2009	Mechanics of Solids	2	0	0	**2**	10	10	-	30	**50**
4.	PCC	MEPCC 2010	Mechanics of Solids Lab	0	0	2	**1**	-	-	25	-	**25**
5.	MD M		Multidisciplinary Minor	3	0	0	**3**	15	15	10	60	**100**
6.	OE		Open Elective-II	3	0	0	**3**	15	15	10	60	**100**
7.	VSEC	MEVSE 2001	Workshop Practices-II	0	0	4	**2**	-	-	25	25	**50**
8.	AEC	EEAEC 2010	Technical Communication	2	0	0	**2**	10	10	-	30	**50**
9.	HSSM	MEEEM 2020	Finance and Accounting	2	0	0	**2**	10	10	-	30	**50**
10.	VEC	INVEC 1001	Universal Human Values -II	2	0	0	**2**	-	-	50	-	**50**
Total				**17**	**0**	**8**	**21**	**75**	**75**	**130**	**320**	**600**

MDM (Offered by Mechanical Department)	**Open Elective – II (Offered by Mechanical Department)**
MEMDM5003 Energy Management / MEMDM6003 Production Technology	MEOEC2020 Total Quality Management / MEOEC2021 Industrial Management / MEOEC2022 Manufacturing Management

Level 5.0 Exit Criteria

Mandatory Courses to be completed after Second Year for obtaining Two Years UG Diploma in Mechanical Engineering

Sr. No	Category	Course Code	Course Title	Teaching Scheme			Credits	Continuous Evaluation in terms of Marks				
				L	T	P		ISE I	ISE II	ISE III	ESE	Total
1.	OJT	MEINT 2001	Internship	0	0	16	**8**	-	-	100	100	**200**
OR												
2.	VSEC	MEVSE 2002	CNC Programming*	0	0	8	**4**	-	-	50	50	**100**
3.	VSEC	MEVSE 2003	Skill Development	0	0	8	**4**	-	-	50	50	**100**

***Equivalent online courses (NPTEL/SWAYAM/MOOC/COURSERA/OTHERS) will be approved by BoS Chairman**

MEPCC2001: Machine Drawing		
Teaching Scheme	**Examination Scheme**	
Lectures: 3 Hrs. / Week	ISE I	15 Marks
Credits: 3	ISE II	15 Marks
	ISE III	10 Marks
	End Semester Examination	60 Marks

Course Objectives:

1. Understanding of drawing, which includes clear visualization of objects and the proficiency in reading and interpreting a wide variety of production and assembly drawings
2. To apply fundamental concepts of various curves and its use in manufacturing
3. To understand and apply national and international standards while drawing machine component.
4. To understand the concept of various tolerances and fits used for component design
5. To familiarize in drawing assembly/disassembly, orthographic and sectional views of various machine Components

Course Outcomes:

After completing the course students will able to

Course Outcomes		Bloom's Taxonomy Level	Unit
CO1	Identify the national and international standards pertaining to machine drawing.	K1	1,2,3,4,5
CO2	Apply limits and tolerances to assemblies and choose appropriate fits.	K2	1,2,3,4,5
CO3	Recognize machining and surface finish symbols.	K2	1,2
CO4	Explain the functional and manufacturing datum.	K2	2,3,4,5
CO5	Illustrate various machine components through drawings	K3	1,2,4,5

Detailed Syllabus:

Unit 1	**Engineering Curves**: Conics section, Cycloidal curves, Involute curves, and spirals Directrix, focus, eccentricity, Normal & Tangents, Construction of ellipse by directrix focus method, concentric circle method, arcs of circle method, oblong method, Construction of Parabola / hyperbola by directrix focus method, Rectangle method, Tangent method, Cycloid- Epicycloids & hypocycloid, Trochoid – Epitrochoid & Hypotrochoid
Unit 2	**Intersection of Surfaces**: Line or Curve of intersection of two solids, Methods: Line method, Cutting-plane method. Intersection of vertical prism with prism, cylinder, cone (Horizontal or Inclined), Intersection of vertical Cylinder with cylinder, cone, Intersection of vertical cone with cone, prism.
Unit 3	**Development of Surfaces:** Introduction, Methods of Development, Development of lateral surfaces of right solids- Cube, Prism, Cylinders, Pyramids, Cone, Development of Transition Pieces, Spheres
Unit 4	**Assembly and Details Drawing:** Assembly and part drawings of simple assemblies and sub-assemblies of machine parts viz., couplings, clutches, bearings, gear

	assemblies, I.C. Engine components, valves, machine tools, etc. Applying Limits, fits and tolerances to the assembly and detail drawings
Unit 5	**Threaded Fasteners:** Screw thread terminology-Conventional representation of External threads and internal threads, Drawing top and front view of hexagonal headed bolt with nut across flat and corner, drawing square headed bolt across corner and flat-cylindrical headed bolt-Eye bolt. **Riveted Joints:** Types of riveted joints, drawing sectional front view and top view of single riveted lap joint, double riveted lap joint with chain riveting and zigzag riveting. Conventional Representation Standard convention using SP - 46 (1988), Surface roughness, Indication of machining-symbol showing direction of lay, roughness grades, machining allowances, Machining symbols used in industry. Standard convention of Knurling, splined shafts, chain wheels, Springs with square and flat ends, Gears, sprocket wheel, Countersunk &counter bore

Text and Reference Books

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

Mapping of Course outcomes with Program outcomes and Program Specific Outcomes:

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	1		1	1									2	
CO2	1	2	1										2	1
CO3	3	1												1
CO4	2		2	1									1	
CO5	1		1	1						1			1	

1 – Low, 2 – Medium, 3 – High

Assessment:

ISE I: Shall be on class test on the basis of 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	ISE1	ISE2	ISE3	End Semester Examination
K1	Remember	5	5		20
K2	Understand	5	5	5	20
K3	Apply	5	5	5	20
K4	Analyse				
K5	Evaluate				
K6	Create				
Total Marks 100		15	15	10	60

MEPCC2002: Machine Drawing Lab		
Teaching Scheme	**Examination Scheme**	
Practical: 02 Hrs. /Week	End Semester Examination	25 Marks
Credit: 01		

Course Outcomes:

After completing the course students will able to

Course Outcomes	
CO1	Understand the knowledge of engineering graphics principles to interpret and generate engineering drawings.
CO2	Understand the conventions and standards used in machine drawings (e.g., dimensioning, tolerances, symbols).
CO3	Demonstrate a fundamental understanding of various machine components and their assembly.

List of the Experiments:

The student shall perform following experiments:

Sr. No.	Title of the Experiments
1	Drawing application-based problems of Engineering Curves
2	Drawing application-based problems of Intersection of solids
3	Drawing application-based problems on Development of Surfaces
4	Assembly drawings of simple assemblies and sub-assemblies of machine parts incorporating Limits, fits, and tolerances
5	Part drawings of simple assemblies and sub-assemblies of machine parts incorporating Limits, fits, and tolerances
6	Drawing application-based problems on Threaded Joints
7	Drawing application-based problems on Riveted Joints
8	Problems on Conventional Representation of standards and Machining Symbols.

End Semester Evaluation

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

End Semester Evaluation will be conducted by two examiners, one will be the course coordinator and other will be examiner appointed by BoS

Mapping of Course outcomes with Program outcomes and Program Specific Outcomes:

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	2	1	1	1					1			1	2	
CO2	1	1	2	1					1			1	2	1
CO3	3	1	1	1					1					1

1 – Low, 2 – Medium, 3 – High

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	End semester Examination
S1	Implementation	10
S2	Manipulation	08
S3	Precision	07
S4	Articulation	
S5	Naturalization	
Total Marks		25

MEPCC2003: Manufacturing Processes		
Teaching Scheme	**Examination Scheme**	
Lectures: 02 Hrs. / Week	ISE I	10 Marks
Credits: 02	ISE II	10 Marks
	End Semester Examination	30 Marks

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

Course Outcomes:
After completing the course students will able to

Course Outcomes	
CO1	Interpret foundry practices like pattern making and core making.
CO2	Understand various moulding methods.
CO3	Know various casting methods
CO4	Classify different plastic fabricating methods of plastic.
CO5	Differentiate various metal forming processes such as Hot and Cold working.

Detailed Syllabus:

Unit 1	**Pattern Making** Introduction, pattern materials, factors affecting selection of pattern materials, master patterns, pattern allowances, types of patterns and their applications, core, core print, core boxes.
Unit 2	**Mould Making** Introduction, moulding sands, grain shape and size of sand, properties of moulding sand, moulding processes, moulding processes based on sand used, making a green sand mould, typical moulding problems, machine moulding
Unit 3	**Casting** Various types of castings such as sand-casting permanent mould or gravity die casting, semi-permanent mould casting, slush casting pressed casting, die casting, centrifugal casting, investment of lost wax casting, plaster mould casting, industrial applications of various types of castings, casting defects.
Unit 4	**Plastics and Their Processing** Plastic. Thermoplastic and thermosetting plastics. Plastic processing methods such as compression moulding, transfer moulding, injection moulding, extrusion, casting, slush moulding and calendaring. Plastic fabricating methods such as blow moulding and forming. Industrial applications of various plastic processes.
Unit 5	**Mechanical Working of Metals** Hot working processes such as hot rolling, types of hot rolling mills, piercing of seamless tubing, drawing, deep drawing, hot spinning. Cold working processes such as cold rolling, cold drawing, cold bending, cold spinning. Industrial applications of various hot working and cold working processes. Introduction to forging processes, hand forging, power forging, impression die forging, drop hammers, press forging, roll die forging press verses hammer forging, defects in forging, industrial applications of forging.

Text and Reference Books

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

Mapping of Course outcomes with Program outcomes and Program Specific Outcomes:

Course Outcomes	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	1		1	1			1		2			1	1	1
CO2	3						1		1			1		1
CO3	1				1							1		
CO4	3													
CO5	2	1			1	1			1			2		

1 – Low, 2 – Medium, 3 – High

Assessment:

ISE 1: Shall be based on class test 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 levels no.	Knowledge levels	ISE I	ISE II	ESE
K1	Remember	4	4	6
K2	Understand	4	4	6
K3	Apply	3	3	6
K4	Analyze	0	0	6
K5	Evaluate	0	0	6
K6	Create	Nil	Nil	Nil
Total Marks 50		10	10	30

Assessment table:

Assessment Tool	**K1 to K3**	**K1 to K3**	**K1 to K3**	**K1 to K3**	**K1 to K3**
COs	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
ISE I (10 Marks)	5	5			
ISE II (10Marks)			5	5	
ESE (30 Marks)	06	06	06	06	06
Total Marks 50	11	11	11	11	06

MEPCC2005: Engineering Thermodynamics		
Teaching Scheme	**Examination Scheme**	
Lectures: 02 Hrs. / Week	ISE I	10 Marks
Credits: 02	ISE II	10 Marks
	End Semester Examination	30 Marks

Course description:
This course offers a fundamental understanding and application of engineering thermodynamics laws to various practical applications such as engines, power plants, heat exchangers, and pumps. It covers steam formation, properties, and the use of steam tables and Mollier diagrams. Theoretical analysis of various air standard cycles.

Course Outcomes:
After completing the course students will able to

Course Outcomes	
CO1	Use of the First and Second Laws of Thermodynamics to solve steady flow process problems in engineering devices
CO2	Utilize steam tables and Mollier diagrams to analyze steam properties and determine the dryness fraction.
CO3	Analyze the efficiencies of air standard cycles, such as Carnot, Otto, Diesel, and Brayton.

Detailed Syllabus:

Unit 1	**First Law applied to Steady Flow Processes** steady flow processes, SFEE, modification of SFEE for different engineering devices such as nozzles, blowers, I.C. Engines, Compressors, Pumps, Turbines, throttling devices (Numerical Treatment) **Second Law of Thermodynamics** Limitations of first law of thermodynamics, Kelvin Planks, Clausius statement and their equivalence, PMM2, thermodynamic temperature scale, Energy, Energy as property of system, Entropy, entropy as a property, reversible process and irreversible process, (Numerical Treatment)
Unit 2	**Properties of steam and pure substances** Phase transformation, p-v phase diagram, critical point, Triple point, Enthalpy and Entropy of steam, steam tables, processes of steam, Enthalpy- Entropy diagram, steady flow process and determination of dryness fraction of steam (Numerical Treatment)
Unit 3	**Power cycles** Definition of cycles, power producing cycles and power consuming cycles, Air standard cycles, air standard efficiency, Carnot cycle, Otto cycles, Diesel cycles, Dual combustion cycles, Comparison of Otto, Diesel and dual combustion cycles, Fuel air cycle, Brayton cycles (Numerical Treatment)

Text and Reference Books

1. Nag P.K., "*Engineering Thermodynamics*", TMH Publishing Co. New Delhi.
2. Ballaney P.L., "*Thermal Engineering*", Khanna Publications, New Delhi.
3. Rajput R.K., "*A Textbook of Engineering Thermodynamics*", Laxmi Publication, New Delhi
4. Domkundwar S, Kothandaraman C. P. & Domkundwar A., "*A Course in Thermal Engineering*", Dhanpat Rai and Co. publication, New Delhi.
5. Rao Y. V. C., "*Engineering Thermodynamics*", Universities Press, Hyderabad
6. Yunus A. Cengel, Michael A. Boles, "*Thermodynamics: An Engineering Approach"* McGraw-Hill Education

Mapping of Course outcomes with Program outcomes and Program Specific Outcomes:

Course Outcomes	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	3			2			1		1			3	
CO2	3			2	2				1		2		2	1
CO3	3	3	1	2			2					1	3	

1 – Low, 2 – Medium, 3 – High

Assessment:

ISE 1: Shall be on the basis of Class Tests on first unit also Assignments/ Quizzes/ Field visits/Presentations/ Course Projects on first unit.

ISE II: Shall be based on class test on second unit.

Assessment pattern:

Assessment pattern levels no.	Knowledge levels	ISE I	ISE II	ESE
K1	Remember	3	3	9
K2	Understand	3	3	9
K3	Apply	2	2	6
K4	Analyze	2	2	6
K5	Evaluate			
K6	Create			
Total Marks 50		**10**	**10**	**30**

Assessment table:

Assessment Tool	K1, K2 and K3	K1, K2 and K3	K1, K2, K3 and K4
	CO1	**CO2**	**CO3**
ISE I (10 Marks)	10	-	-
ISE II (10Marks)	-	5	5
ESE (30 Marks)	7	11	12
Total Marks 50	**17**	**16**	**17**

MEPCC2006: Engineering Thermodynamics Lab		
Teaching Scheme	**Examination Scheme**	
Practical: 02 Hrs. / Week	End Semester Examination	25 Marks
Credits: 01		

Course Outcomes:

After completion of this course students will be able to:

	Course Outcomes
CO1	Understand the function of boiler and its mountings and accessories
CO2	Perform energy analysis of exhaust gas and refrigerator.
CO3	Determine the dryness fraction of steam experimentally using a calorimeter.
CO4	Communicate effectively through the preparation of laboratory and industry visit reports

List of the Experiments

The student shall perform minimum eight experiments of the following

Sr. No.	Title of the Experiments	Skill / Knowledge Level	CO
1	Study of boilers (any two) and its mounting and accessories	K2	CO1 and CO4
2	Study of boilers mounting and accessories	K2	CO1and CO4
3	Study of refrigerator and its energy analysis as per First and Second Law of thermodynamics	K2	CO2 and CO4
4	Study and determination of C.V. of solid fuel using Bomb Calorimeter.	K3	CO2 and CO4
5	Study and determination of C.V. of gaseous fuels	K3	CO2 and CO4
6	Analysis of exhaust gases using NDIR apparatus.	K3	CO2and CO4
7	Determination of dryness fraction of steam using tank calorimeter.	K3	CO3 and CO4
8	Determination of dryness fraction of steam using tank calorimeter throttling calorimeter	K3	CO3 and CO4
9	Visit to industry related to thermodynamics (e.g. milk processing plant, cold storage).	K2	CO4

Mapping of Course outcomes with Program outcomes:

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	3	2	2				1					2	1	
CO2	2	3	2		3					2	2			
CO3	1	2	2	3					1		2		1	
CO4						3		3	2	3		1	1	

1 – Low, 2 – Medium, 3 – High

Assessment Pattern:

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

MEEEM2010: Industrial Engineering		
Teaching Scheme	**Examination Scheme**	
Lectures: 02 Hrs. / Week	ISE I	10 Marks
Credits: 02	ISE II	10 Marks
	End Semester Examination	30 Marks

Course Objectives:

1. To understand the use of work study, method study and Time study analysis related to production.
2. To study about the Plant location and layouts.
3. To enable to use the Demand forecasting and Production information system

Course Outcomes:

After completing the course students will able to

Course Outcomes	
CO1	Apply methods of motion and time study for industrial problems.
CO2	Assess the plant location and design the plant layout.
CO3	Select and apply forecasting method for particular application.

Detailed Syllabus:

Unit 1	**Work Motion & Time Study:** Work Study Introduction, advantages of work study, method study, objectives of method study, scope of method study, steps involved in method study, charts used in method study, motion study, principles of motion study, recording techniques of motion study, work measurement, objectives of work measurement, techniques of work measurement, time study, computation of standard time, introduction to MOST.
Unit 2	**Plant Location and Layout: Plant Location:** Introduction, importance of plant location, dynamic nature of plant location, factors responsible for plant location, location analysis. **Plant Layout:** Introduction and meaning, objectives of layout, principles of plant layout, advantages of good layout, types of layouts, techniques of plant layout, features of good layout, factors relevant for the choice of layout, revising and improving plant layout
Unit 3	**Demand Forecasting:** Introduction, objectives of demand forecasting, importance of demand forecasting, steps in forecasting, techniques of forecasting, other methods of forecasting. **Production Information System:** Introduction, fundamentals of production information system, production planning system, production control system, materials management information systems Reliability: Introduction, Concepts and applications in Engineering. Use of modern tools for forecasting

Text and Reference Books

1. "Introduction to Work Study", ILO, Geneva
2. Barnes, R, "Motion and Time Study" – Design and Measurement of Work. NY: John Wiley and Sons.
3. Martand T. Telsang, 'Industrial Engineering and Production Management' S Chand.
4. Mahajan M., "Industrial Engineering and Production Management" Dhanpat rai and Sons Publishers

Mapping of Course outcomes with Program outcomes and Program Specific Outcomes:

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	1		1		2		2		2			1	1	
CO2					3								2	
CO3		3			3							1	2	

1 – Low, 2 – Medium, 3 – High

Assessment:

ISE 1: Shall be on the basis of Class Tests on first unit also Assignments/ Quizzes/ Field visits/Presentations/ Course Projects on first unit.

ISE II: Shall be based on class test on second unit.

Assessment Pattern:

Assessment Pattern Level No.	**Knowledge Level**	**ISE I**	**ISE II**	**ESE**
K1	Remember	4	4	10
K2	Understand	4	4	10
K3	Apply	2	2	10
K4	Analyze	0	0	0
K5	Evaluate	0	0	0
K6	Create	0	0	0
Total Marks 50		**10**	**10**	**30**

Assessment Tool	K1 TO K3	K1 TO K3	K1 TO K3
COs	CO1	CO2	CO3
ISE-I [10 Marks]	6	4	-
ISE-II [10 Marks]	-	4	6
ESE [30 Marks]	10	10	10

CEVEC0010: Environmental Science		
Teaching Scheme	**Examination Scheme**	
Lectures: 02 Hrs. / Week	ISE I	10 Marks
Credits: 02	ISE II	10 Marks
	End Semester Examination	30 Marks

Course Objectives:

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

Course Outcomes:

After completing the course students will able to

Course Outcomes	
CO1	Learn about the basics of environment.
CO2	Understand the harmful effects of human activities on environment and their solutions
CO3	Understand the biodiversity, conservation methods and factors for the loss of biodiversity
CO4	Understand the concept of climate change, global warming, acid rain, various disasters and its mitigation measures

Detailed syllabus:

Unit-I	**A) Understanding Environment** - Environment: concept and importance - Components of environment: Physical, Biological and Social - Ecosystem Concept, Structure and Function - Producers, Consumers and Decomposers - Food chain, Food web and Ecological pyramids - Energy flew in an Ecosystem. - Ecosystem services Ecological, economic, social, aesthetic and informational **B) Natural Resources** - Land resources: global land use patterns, concept land degradation and desertification - Forest resources: Use and consequences of over-exploitation - Water resources: Use and consequences of over-utilization, concept of water harvesting and watershed management, water conflicts - Energy resources Renewable and non-renewable energy sources, growing energy needs and alternate energy sources
Unit-II	**A) Biodiversity and its conservation** - Biodiversity definition, levels (genetic, species and ecosystem) and values - Threats to biodiversity: habitat loss, poaching of wildlife, biological invasions - Concept of endemism and hot spots of biodiversity

	- Conservation of biodiversity: In-situ and Ex-situ concepts **B) Environmental Pollution** -Causes, effects and control measures of Air, water, soil, noise, thermal, nuclear; -Solid waste management -Liquid waste management
Unit-III	**Environmental issues, policies and practices** - Global environmental issues: Increase in greenhouse gases, climate change, Acid rain and stratospheric ozone layer depletion - Salient features of Environment Protection Act, 1986 - Environmental education: Formal and Informal education - Environmental Movements (Chipko Movement, Silent valley) and Environmental ethics

Text and Reference Books

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

Mapping of Course outcomes with Program outcomes and Program Specific Outcomes:

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	3		1											
CO2	3		1											
CO3	3		1											
CO4	3		1											

1 – Low, 2 – Medium, 3 – High

Assessment Pattern

Assessment Pattern Level No.	**Knowledge Level**	**ISE-I**	**ISE-II**	**End Semester Examination**
K1	Remember	02	02	10
K2	Understand	04	04	10
K3	Apply	04	04	10
K4	Analyze	00	00	00
K5	Evaluate	00	00	00
K6	Create	00	00	00
Total Marks 50		10	10	30

Assessment table

Assessment Tool	CO1	CO2	CO3	CO4
	K1+K3	K1+K3	K1+K3	K1+K3
ISE I (10 Marks)	5	5	5	
ISE II (10 Marks)		5	5	5
ESE Assessment (30 Marks)	8	8	7	7

MECEP2001: Mini Project		
Teaching Scheme	**Examination Scheme**	
Practical: 04 Hrs. /Week	ISE III	25 Marks
Credit: 02	End Semester Examination	25 Marks

Course Objectives:

1. To make the student conversant with industrial activities / project execution activities
2. To exemplify various industrial aspects in manufacturing processes and industrial design
3. Student will able to analyze and solve industrial mini problem / work on in-house project

Course Outcomes:

After completing the course students will able to

Course Outcomes	
CO1	Illustrate industrial project / in-house project
CO2	Identify industrial problems / in-house
CO3	Integrate and apply the knowledge gained through different courses into practical problems
CO4	Prepare a consolidated report

Detailed description:

1. Student shall identify and collect pragmatic industrial information / in-house project / social problem as a Mini Project.
2. Student shall obtain a solution by applying suitable techniques
3. Student has to exhibit the continuous progress review through regular reporting and presentations (at least two during semester) and proper documentation of the frequency of the activities. The continuous assessment of the progress needs to be documented unambiguously. Progress will be monitored by an evaluation committee consisting of guide, two faculty appointed by the BoS / Head of Department / BoS Chairman.
4. The candidate shall submit the report on Mini Project in standard format for satisfactory completion of the work, duly approved and certified by the concerned guide, Head of the Department and Principal.
5. The candidate will be assessed during ESE by two examiners, one of whom will be the guide and other is necessarily an external examiner appointed by the BoS / Head of Department / BoS Chairman. The assessment will be broadly based on work undergone, content delivery, presentation skills, documentation and report.
6. For standardization and documentation, it is recommended to follow the formats and guidelines approved by the Board of Studies.

Mapping of Course outcomes with Program outcomes and Program Specific Outcomes:

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	3	1	1	1					1			1	1	
CO2	2	3		2		1		1				1	1	
CO3	3	1	1	1		1			1			1		
CO4	2								1	2	1	2	1	

1 – Low, 2 – Medium, 3 – High

Assessment:

ISE III- Continuous Assessment of individual student Maximum Marks-25
ESE – Viva Voce based on presentation and report Maximum Marks-25

Assessment Pattern:

Assessment Pattern Level No.	**Knowledge Level**	**ISE II**	**ESE**
S1	Implementation	04	04
S2	Manipulation	03	03
S3	Precision	14	14
S4	Articulation	04	04
S5	Naturalization	00	00
Total Marks		**25**	**25**

Knowledge Level	**ISE II**	**ESE**
Preparation S1	04	04
Articulation of problem S4	04	04
Observation S3	08	08
Record S2	03	03
Mini project/ Presentation/Viva Voce S3	06	06
Total Marks	**25**	**25**

MEPCC2007: Material Science and Metallurgy		
Teaching Scheme	**Examination Scheme**	
Lectures: 3 Hrs. / Week	ISE I	15 Marks
Credits: 3	ISE II	15 Marks
	ISE III	10 Marks
	End Semester Examination	60 Marks

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

Course Outcomes:

After completing the course students will able to

Course Outcomes		**Bloom's Taxonomy Level**	**Unit**
CO1	Understand the importance of materials properties and identify the material for specific applications.	K1	1,2,3,4,5
CO2	Understand distinguish microstructure and analyze the effect of Crystalline nature of metals.	K2	1,2,3,4,5
CO3	Understand the importance of materials properties and identify the material for specific applications.	K2	1,2
CO4	Understand distinguish microstructure and analyze the effect of Crystalline nature of metals.	K2	2,3,4,5
CO5	Analyze and implement suitable heat treatment processes.	K3	1,2,4,5

Detailed Syllabus:

Unit 1	**Introduction to Materials & Metallography: -** Classification of materials, Properties, applications of materials, Evaluation of tensile and hardness, Classification of metallurgy as Ferrous and Non-Ferrous Metallurgy, Crystal System, Bravais Lattices and Crystal Imperfection, Alloys and solid solutions, types, and their formations, Hume-Rothery' rules, modified Gibbs's phase rule, Metallography, specimen preparation, optical metallurgical microscope.
Unit 2	Equilibrium Diagrams for systems like isomorphous, eutectic, peritectic. Lever rule for phase mixtures and their application in system. Types of cooling curves. Iron-Iron carbide equilibrium diagram, Allotropy, cooling curve of pure iron, Critical temperatures. Microstructure of slowly cooled steels. Estimation of carbon from microstructures. Property variation with microstructure
Unit 3	**Steel & Alloy steel and Bio Materials: -** Classification and application of plain carbon steels. Classification and applications of steels. Specification of steels, Effect of alloying elements. Tensile, compression, torsion, fatigue, fracture and wear tests; Young's modulus; Relations between true and engineering stress-strain curves; Yielding and yield strength; ductility, resilience, toughness and elastic recovery;

	Hardness measurement their relation to strength, Bio Materials and its application
Unit 4	**Heat Treatment: -** Heat treatment of Steel; Annealing, tempering, normalizing, spheroidising, austempering, martempering, case hardening, carburizing, nitriding, cyaniding, carbo-nitriding, flame and induction hardening, vacuum and plasma hardening
Unit 5	**Composite Material: -** Polymers – Classification and applications; Polymerization techniques; Ceramics – Oxide ceramics, ceramic insulators, bio-ceramics and Glasses; Composites – Reinforcement, matrix, metal matrix composites, ceramic composites, polymer composites; Other advanced materials – biomaterials, optical materials, high temperature materials, energy materials, and nanomaterials.

Text and Reference Books

1. W. D. Callister, "Materials Science & Engineering," Wiley India.
2. K. G. Budinski and M.K. Budinski, "Engineering Materials", PHI India.
3. V. Raghavan, "Material Science and Engineering', PHI India.
4. U. C. Jindal, "Engineering Materials and Metallurgy", Pearson.
5. M.F. Ashby and D.R.H. Jones, Engineering Materials 1 - An Introduction to Properties, Applications and Design, Butterworth-Heinemann, USA.

Mapping of Course outcomes with Program outcomes and Program Specific Outcomes:

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	2	1	1		2								1	
CO2	2	1	1	1	1							1	2	
CO3	2	1	1									1		
CO4	2	1	2	1									1	
CO5	1	1	1	1								1		

1 – Low, 2 – Medium, 3 – High

Assessment:

ISE I: Shall be on class test on the basis of 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 1	ISE 2	ISE 3	End Semester Examination
K1	Remember	5	5		20
K2	Understand	5	5	5	20
K3	Apply	5	5	5	20
K4	Analyse				
K5	Evaluate				
K6	Create				
Total Marks 100		15	15	10	60

MEPCC2008: Material Science and Metallurgy Lab		
Teaching Scheme	**Examination Scheme**	
Practical: 02 Hrs. /Week	End Semester Examination	25 Marks
Credit: 01		

Course Outcomes:

After completing the course students will able to

Course Outcomes	
CO1	Understand the relationship between structure of materials and their properties.
CO2	Understanding the principle of working of metallurgical microscopes
CO3	Understand the significance of observation of microstructure of plain carbon steels / Alloy and steels
CO4	Understand and observe microstructure of Cast Iron/ Non-Ferrous Alloys.

List of the Experiments:

The student shall perform following experiments:

Sr. No.	**Title of the Experiments**
1	Demonstration and Observation of the different Crystal Systems.
2	Illustration and Operation of Metallurgical Microscope.
3	Demonstration and Observation of Microstructure of the Plain Carbon Steels.
4	Illustration and Observation of Microstructure of Alloy Steels.
5	Relate Microstructure of Cast Iron.
6	Demonstration and Observation of Microstructure of the Non Ferrous alloys.
7	Industrial Visit to a metallurgical industry for advanced materials
8	Industrial Visit to a material related industry for advanced instrumentation of material analysis

Mapping of Course outcomes with Program outcomes and Program Specific Outcomes:

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1		2	1									1	1	2
CO2	1		2									1	1	1
CO3	1	2										1		
CO4	2		2		3							1	1	

1 – Low, 2 – Medium, 3 – High

End Semester Evaluation

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

End Semester Evaluation will be conducted by two examiners, one will be the course coordinator and other will be examiner appointed by BoS

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	End semester Examination
S1	Implementation	05
S2	Manipulation	10
S3	Precision	10
S4	Articulation	00
S5	Naturalization	00
Total Marks		25

MEPCC2009: Mechanics of Solids		
Teaching Scheme	**Examination Scheme**	
Lectures: 02 Hrs. / Week	ISE I	10 Marks
Credits: 02	ISE II	10 Marks
	End Semester Examination	30 Marks

Course Objectives:

The objectives of offering this course are to-

1. Describe the behavior of material at various in compression and tension.
2. Understand and analyze shear force and bending moment in various loading conditions.
3. Know the phenomenon of bending of different sections and its analysis and recognize principal stresses.
4. Explain various columns sections and geometrical analysis.

Course Outcomes (COs):

At the end of the course, the student will be able to

CO1	Apply compression and tension test results to understand stress, strain, Young's modulus etc
CO2	Develop SFD and BMD for various conditions
CO3	Explain Torsion, bending concept to determine various stresses columns conditions and develop numerical ability

Detailed Syllabus:

Unit 1	**Introduction** Stresses and Strains: definition–stress, strain, Hooke's law, elastic limit, uni-axial, bi-axial and tri-axial stresses, tensile & compressive stresses, shear stress, principal stresses and strains, Mohr's circle, elastic constants: Poisson's ratio, modulus of elasticity, modulus of rigidity, bulk modulus, yield stress, ultimate stress, factor of safety, state of simple shear, relation between elastic constants, volumetric strain, volumetric strain for tri-axial loading, deformation of tapering members, deformation due to self –weight, bars of varying sections, composite sections, thermal stress and strain.
Unit 2	**Shear Force and Bending Moment and Stress in Beams** Review of moment of inertia, axial force, shear force and bending moment diagrams for statically determinate beams including beams with internal hinges for different types of loading, relationship between rates of loading, shear force and bending moment. Stresses in beams: theory of pure bending, assumptions, flexural formula for straight beams, moment of resistance, bending stress distribution, section modulus for different sections, beams for uniform strength, flitched beams, direct and bending stresses: core of sections, chimneys subjected to wind pressure, shear Stress in beams: distribution of shear stress across plane sections used commonly for structural purposes, shear connectors. Introduction to tensor analysis
Unit 3	**Torsion and Columns and Struts** Torsion of circular shafts- solid and hollow, stresses in shafts when transmitting power, shafts in series and parallel, columns and struts: buckling load, types of end conditions for column, Euler's column theory and its limitations, Rankine and Johnson formula.

Text Books:

1. S. Ramamurtham & R. Narayanan, Strength of Materials, Dhanpat Rai Publishing Company (P) Limited.
2. I. B. Prasad, Strength of Materials, Khanna publication.
3. R. K. Bansal, Strength of Material, Laxmi Publication.
4. B. C. Punmia, Strength of Material, Standard publisher and distributors.
5. R. K. Rajput, Strength of Material, S. Chand Publication,2015

Reference Book:

1. Gere. James M. & S. Timoshenko, Mechanics of Materials, Indian Reprint, CBS Publisher & Distributor, New Delhi.
2. Dr. H. J. Shah and S. B. Junnarkar, Mechanics of Structure, Charotar Publication House, Anand.
3. Beer, Johnston and DeWolf, Mechanics of Materials, Tata McGraw Hill Publication, New Delhi.
4. Ferdinand Beer and Jr., E. Russell Johnston, Strength of Materials, Tata McGraw Hill, New Delhi.

Mapping of Course outcomes with Program outcomes and Program Specific Outcomes:

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	3	1	2	1								1	1	
CO2	2	1	3	2								1	1	
CO3	3	1	1	1								1		1

1 – Low, 2 – Medium, 3 – High

Assessment:

ISE 1: Shall be on the basis of Class Tests on first unit also Assignments/ Quizzes/ Field visits/Presentations/ Course Projects on first unit.

ISE II: Shall be based on class test on second unit.

Assessment Pattern

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	End Semester Examination
K1	Remember	04	04	10
K2	Understand	04	04	10
K3	Apply	02	02	10
K4	Analyze	00	00	00
K5	Evaluate	00	00	00
K6	Create	00	00	00
Total Marks 50		10	10	30

Assessment table

Assessment Tool	K1 to K4	K1 to K4	K1 to K4
Cos	CO1	CO2	CO3
Class Test I (10Marks)	5	5	
Class Test II (10Marks)		5	5
ESE Assessment (30Marks)	10	10	10

MEPCC2010: Lab- Mechanics of Solids		
Teaching Scheme	**Examination Scheme**	
Practical: 02 Hrs. / Week	ISE III	25 Marks
Credits: 01		

Course Objective:

1. Observe the response of the materials under different loads and measure various mechanical properties.
2. Observe the failure pattern of different metals tested in different scale.
3. Study the Impact testing machine

Course Outcomes:

After completion of this course students will be able to:

	Course Outcomes
CO1	Observe the behavior of materials by conducting Tension, Compression & Shear
CO2	Evaluate the Impact Strength of Material.
CO3	Determine Elastic constants of a given material using flexural and torsion tests.

List of the Experiments

List of Experiments in Solid Mechanics Lab (An Eight):

S. No	Name of the Experiment
1	Compression test on helical spring.
2	Tension test on mild steel rod.
3	Double shear test on metals.
4	Torsion test on mild steel rod.
5	Impact test on metal specimen. (a) Izod Impact Test
6	Impact test on metal specimen. (b) Charpy Impact Test
7	Deflection test on beams. (a) Cantilever Beam(b) Simply Supported beam
8	Compression test on brittle materials
9	Flexural strength of a beam
10	Brinell hardness test of metal specimen
11	Effect of wind load on static structure

Mapping of Course outcomes with Program outcomes and Program Specific Outcomes:

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	1		1	1								1		
CO2	2	2		1	1									
CO3	1		3	1								1		1

1 – Low, 2 – Medium, 3 – High

Assessment Pattern:

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

Knowledge Level	**ISE II**
Preparation S1	04
Conduct of Experiment S2	04
Observation & analysis of Results S3	08
Record S2	03
Mini project/ Presentation/Viva Voce S3	06
Total Marks	25

MEVSE2001: Workshop Practice – II		
Teaching Scheme	**Examination Scheme**	
Practical: 04 Hrs. / Week / Batch	ISE-I	25 Marks
Credits: 02	ESE	25 Marks

Course Outcome	Bloom's Taxonomy Level
CO1: **Apply** various foundry shop techniques, including the use of hand tools and the preparation of moulds using different patterns, to produce ferrous and non-ferrous metal castings.	K1, K2, K3
CO: 2 **Perform** sheet metal work, including cutting, bending, riveting, soldering, and brazing, to create items such as trays, flower vessels, and photo frames.	K1, K2, K3, K6
CO3: **Execute** various lathe and milling machine operations, such as taper turning, threading, facing, gear cutting, and slot cutting, to complete assigned machining jobs.	K3, K6
CO4: **Examine** the effects of heat treatment and hot and cold working processes on the physical and internal properties of metals, understanding their applications in industrial settings.	K1, K2, K4, K5

List of the Experiments:

Sr	Title of the experiment	Skill level	CO
1.	**Foundry shop:** Familiarization of Foundry tools Hand tools, shovel, riddle, hammers, trowels, relic, lifters, strike off bar spruce, balloons, swab, gate Cutter, mallet, vent rod, draw spike, lifting plate, pouring weight, gaggers, clamps, core & chaplets. Moulding practice and casting preparation of moulding sand, prepare moulds of different types using different patterns (single, double- & three-piece patterns), ferrous and Non ferrous metal casting using simple patterns. **Job: one practical experiment on preparing sand mold using the given Single or Split-piece Pattern.**	S1	CO1
2.	**Industrial visit to any plastic manufacturing industry and sheet metal working industry:** Use of sheet metal, working hand tools, cutting, bending, Exercise in riveting, soldering and brazing, making items such as trays, flowers vessels, lamp-sheds, photo - frame etc.	S2	CO2
3.	**Turning shop:** Study of different operations on the lathe machine, machining time calculations, taper turning (calculations), single point cutting tool operations, internal external threading, facing, finishing cuts etc. **Job: preparing a job lathe machine performing the above operations one job per student**	S3	CO3
4.	**Machine shop:** Study of different operations to be carried on the milling machine, indexing, gear cutting, slot cutting. Spline cutting etc. **one job on shaping machine, milling machine and one forging job to be demonstrated and a simple job to be**	S4	CO3

	made for Term Work in a group of 4 students		
5	**Hot and Cold Working Processes** These processes are employed to impart certain specific properties to the metal parts so as to make them suitable for particular operations. Most physical properties like hardening, softening and grain refinement etc., call for particular heat treatment. Heat treatments not only affect the physical properties, but in most cases also make a marked change in the internal structure of the metal. So is the case with cold and hot working of metals. 1. Heat treatment 2. Cold working 3. Hot working **One Industrial visit for demonstration.**	S4	CO4

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

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

1-High, 2- Medium, 3- Low

Assessment: The ISE I will consist of submitting job with neatly written records in a course file. The term work will be assessed by the course coordinator

End semester evaluation: The evaluation will comprise of practical exam, the evaluation will be done by two examiners

Assessment pattern:

Assessment pattern level no	Knowledge level	ISE I	End semester examination
K1	Remember	5	5
K2	Understand	5	5
K3	Apply	5	5
K4	Analyze	2	2
K5	Evaluate	3	3
K6	Create	5	5
Totals marks		**25**	**25**

Assessment pattern level no	Knowledge level	ISE I	End semester examination
S1	Imitation	5	5
S2	Manipulation	5	5
S3	Precision	5	5
S4	Articulation	5	5
S5	Naturalization	5	5
Totals marks		**25**	**25**

EEAEC2010: Technical Communication		
Teaching Scheme	**Examination Scheme**	
Lectures: 02 Hrs. /Week	ISE I	10 Marks
Credit: 02	ISE II	10 Marks
	End Semester Examination	30 Marks

Course Outcomes:

At the end of the course, the student will be able to

CO1	Understand the nature and objective of Technical Communication relevant for the work place as Engineers.
CO2	Utilize the technical writing for the purposes of Technical Communication and its exposure in various dimensions
CO3	Imbibe inputs by presentation skills to enhance confidence in face of diverse audience.
CO4	Evaluate their efficacy as fluent & efficient communicators by learning the voice-dynamics.

Detailed Syllabus:

Unit I	**Fundamentals of Technical Communication:** Technical Communication: Features; Distinction between General and Technical Communication; Language as a tool of Communication; Dimensions of Communication: Reading & comprehension; Technical writing: sentences; Paragraph; Technical style: Definition, types & Methods; The flow of Communication: Downward; upward, Lateral or Horizontal; Barriers to Communication.
Unit II	**Forms of Technical Communication:** 7 Cs of effective business writing: concreteness, completeness, clarity, conciseness, courtesy, correctness, consideration; Technical Report: Definition & importance; Thesis/Project writing: structure & importance; C.V./Resume writing; Technical Proposal: Types, Structure & Draft. Seminar & Conference paper writing.
Unit III	**Technical Presentation:** Strategies & Techniques Presentation: Forms; interpersonal Communication; Classroom presentation; style; method; Individual conferencing: essentials: Public Speaking: method; Techniques: Clarity of substance; emotion; Humour; Modes of Presentation; Overcoming Stage Fear: Confident speaking; Audience Analysis & retention of audience interest
Unit IV	**Technical Communication Skills and Kinesics & Voice Dynamics:** Interview skills; Group Discussion: Objective & Method; Seminar/Conferences Presentation skills: Focus; Content; Style; Critical thinking; Nuances: Exposition narration & Description; Socio-linguistic competence: Strategic competence: Solution of communication problems with verbal and non verbal means. Definitions; importance; Features of Body Language; Voice Modulation: Quality, Pitch; Rhythm; intonation; Pronunciation; Articulation; stress & accent; Linguistic features of voice control: Vowel & Consonant Sounds.

Text and Reference Books

1. Technical Communication – Principles and Practices by Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press, New Delhi.
2. Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd., New Delhi.
3. Practical Communication: Process and Practice by L.U.B. Pandey; A.I.T.B.S. Publications India Ltd.; Krishan Nagar, Delhi.
4. Modern Technical Writing by Sherman, Theodore A (et.al); Apprentice Hall; New Jersey; U.S.
5. A Text Book of Scientific and Technical Writing by S.D. Sharma; Vikas Publication, Delhi.

Mapping of Course outcomes with Program outcomes and Program Specific Outcomes:

Course Outcomes	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										2				
CO2										3				1
CO3										2				
CO4										3				

1 – Low, 2 – Medium, 3 – High

MEEEM2020: Finance and Accounting		
Teaching Scheme	**Examination Scheme**	
Lectures: 02 Hrs. / Week	ISE I	10 Marks
Credits: 02	ISE II	10 Marks
	End Semester Examination	30 Marks

Course Description:
Explore the need, development, and objectives of accounting, along with transaction processing, income classification, and financial statement preparation, ensuring a solid understanding of core accounting principles.

Course Outcomes:
After completing the course students will be

Course Outcomes	
CO1	Acquire knowledge of basic terms, definitions, concepts and conventions of Book-Keeping and Accountancy.
CO2	Use accounting cycle, journaling techniques, rules of debit and credit, compound and opening entries, ledger relationships, posting rules, trial balance preparation, and journal subdivisions.
CO3	Classify income, expenditure, and receipts, prepare final accounts, and rectify errors to measure and report financial performance accurately.

Detailed Syllabus:

Unit 1	**Meaning and Scope of Accounting** Need, development, and definition of accounting; Bookkeeping and accounting; Persons interested in accounting; Disclosures; Branches of accounting, Objectives of accounting
Unit 2	**Accounting transactions** Accounting Cycle; Journal; Rules of debit and credit; Compound journal entry; Opening entry; Relationships between Journal and Ledger; Rules regarding posting; Trial balance; Sub divisions of journal
Unit 3	**Capital and Revenue** Classification of income; Classification of expenditure; Classification of receipts, accounting concepts of income; Accounting concepts and income measurement; Expired costs and income measurement Final Accounts; Manufacturing account; Trading account; Profit and loss account; Balance Sheet; Adjustment entries, Rectification of errors; Classification of errors; Location of errors; Suspense accounts; Effects on profit.

Text and Reference Books

1. R.L. Gupta, V.K. Gupta, "Financial Accounting", Sultan Chand & Sons, Publication, New Delhi
2. Dr. S. N. Maheshwari and S. K. Maheshwari "Financial Accounting" Publication: Vikas Publishing House Pvt Ltd
3. Prasanna Chandra"Financial Management" Publication Tata McGraw-Hill Education

Mapping of Course outcomes with Program outcomes and Program Specific Outcomes:

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	1				2					1	3	2		
CO2	1				1					1	3	2		
CO3	1	2		1	2				1	2	3	2		

1 – Low, 2 – Medium, 3 – High

Assessment:

ISE 1: Shall be on the basis of Class Tests on First unit also Assignments/ Quizzes/ Field visits/Presentations/ Course Projects.

ISE II: Shall be based on class test on Second unit.

Assessment pattern:

Assessment pattern levels no.	Knowledge levels	ISE I	ISE II	ESE
K1	Remember	3	3	9
K2	Understand	4	4	9
K3	Apply	3	3	12
K4	Analyze			
K5	Evaluate			
K6	Create			
Total Marks 50		**10**	**10**	**30**

Assessment table:

Assessment Tool	K1, K2	K1, K2, K3	K1, K2, K3
	CO1	**CO2**	**CO3**
ISE I (10 Marks)	5	5	-
ISE II (10Marks)	-	-	10
ESE (30 Marks)	12	11	7
Total Marks 50	**17**	**16**	**17**

INVEC1001: Universal Human Values -II Understanding Harmony		
Teaching Scheme	**Examination Scheme**	
Lectures: 02 Hrs. / Week	ISE I Online Examination	10 Marks
Credits: 02	ISE II Online Examination	10 Marks
No. of Teaching Hours 25-28	End Semester Examination Online Examination	30 Marks

Course Objective:

The objective of the course is fourfold:

1. Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
2. Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
3. Strengthening of self-reflection.
4. Development of commitment and courage to act.

Course Outcomes:

After completing the course students will be

Course Outcomes
By the end of the course, students are expected to become more aware of themselves, and their surroundings (family, society, nature); they would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind. They would have better critical ability. They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society). It is hoped that they would be able to apply what they have learnt to their own self in different day-to- day settings in real life, at least a beginning would be made in this direction. This is only an introductory foundational input. It would be desirable to follow it up by a) faculty-student or mentor-mentee programs throughout their time with the institution b) Higher level courses on human values in every aspect of living. E. g. as a professional

Detailed Syllabus:

Unit 1	**Course Introduction - Need, Basic Guidelines, Content and Process for Value Education** Purpose and motivation for the course, recapitulation from Universal Human Values-I Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration. Continuous Happiness and Prosperity- A look at basic Human Aspirations. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario. Method to fulfil the above human aspirations: understanding and living in harmony at various levels. **Home Work:** Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co- existence) rather than as arbitrariness in choice based on liking-disliking

Unit 2	**Understanding Harmony in the Human Being - Harmony in Myself!** Understanding human being as a co-existence of the sentient 'I' and the material 'Body'. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer). Understanding the characteristics and activities of 'I' and harmony in 'I'. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail. Programs to ensure Sanyam and Health. **Home Work:** Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease
Unit 3	**Understanding Harmony in the Family and Society- Harmony in Human- Human Relationship** 1Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship. Understanding the meaning of Trust; Difference between intention and competence. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family. **Home Work:** Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives.
Unit 4	**Understanding Harmony in the Nature and Existence - Whole existence as Coexistence** Understanding the harmony in the Nature. Interconnectedness and mutual fulfilment among the four orders of nature recyclability and self-regulation in nature. Understanding Existence as Co-existence of mutually interacting units in all pervasive space. Holistic perception of harmony at all levels of existence. **Home Work:** Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.
Unit 5	**Implications of the above Holistic Understanding of Harmony on Professional Ethics** Natural acceptance of human values. Definitiveness of Ethical Human Conduct. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems. **Some Case Studies can be given as homework:** Case studies of typical holistic technologies, management models and production systems Strategy for transition from the present state to Universal Human Order:

	a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations Sum up. **Home Work:** Include practice Exercises and Case Studies will be taken up in Practice Sessions eg. To discuss the conduct as an engineer or scientist etc.

Text and Reference Books

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010
2. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
3. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004. 3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi 5. Small is Beautiful - E. F Schumacher.
5. Slow is Beautiful - Cecile Andrews
6. Economy of Permanence - J C Kumarappa
7. Bharat Mein Angreji Raj – Pandit Sunderlal
8. Rediscovering India - by Dharampal
9. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
10. India Wins Freedom - Maulana Abdul Kalam Azad
11. Vivekananda - Romain Rolland (English)
12. Gandhi - Romain Rolland (English)

MODE OF CONDUCT

Lectures hours are to be used for interactive discussion, placing the proposals about the topics at hand and motivating students to reflect, explore and verify them. While analysing and discussing the topic, the faculty mentor's role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements. Such observations and their analyses are shared and discussed with other students and faculty mentor, in a group sitting. Tutorials (experiments or practical) are important for the course. The difference is that the laboratory is everyday life, and practical are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignment and/or activity are included. The practice sessions (tutorials) would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based on basic human values. It is recommended that this content be placed before the student as it is, in the form of a basic foundation course, without including anything else or excluding any part of this content. Additional content may be offered in separate, higher courses.

This course is to be taught by faculty from every teaching department, including HSS faculty.

Teacher preparation with a minimum exposure to at least one 8-day FDP on Universal Human Values is deemed essential.

MEOEC2010: Industrial Psychology		
Teaching Scheme	**Examination Scheme**	
Lectures: 3 Hrs. / Week	ISE I	15 Marks
Credits: 3	ISE II	15 Marks
	ISE III	10 Marks
	End Semester Examination	60 Marks

Course description: Industrial Psychology course intends to impart knowledge to effectively study human behavior in the workplace and implement meaningful measures to improve professional satisfaction, increase productivity and promote overall better quality of life for all individuals in the workplace. Students can apply psychological principles and research methods to identify solutions to problems that improve the well-being and performance of an organization and its employees.

Course Outcomes:

After completing the course, students will able to:

	Course Outcomes
CO1	Define the basic terms related with the concept or theme of Industrial Psychology
CO2	Identify the various leadership roles played by team members in the organization and correlate the concept of motivational theories.
CO3	Understand various aspects of Psychology of Health, Stress, it's causes and consequences in the work and home environment.
CO4	Correlate attitude emotions with the work environment and human being associated with the organization.
CO5	Apply concept of work design in various areas like various profiles, operational design, market related innovations and employees' work-related issues.

Detailed Syllabus:

Unit 1	**Introduction:** Definition, concept, Aim, Objectives, Scope of Industrial Psychology. Individual and group, Individual differences in behavior. Group dynamics, Mc Gregor's Theory X-Theory Y. Hawthorne experiment.
Unit 2	**Leadership and Motivation:** Leadership – definition, traits of effective leaders, leadership skills, behavioural approaches to leadership, Various Leadership Styles, Motivation – Definition, Models of motivation, Various Theories.
Unit 3	**Psychology of Health:** Understanding stress and its various causes, psychologically oriented and physically manifested disorders, Influence of Technological / Industrial environment i.e. AI, Digital technology, social media etc. Stress adjustment; Occupational, Social, Marital, environmental etc.
Unit 4	**Attitude Emotions and Work:** Work Attitudes, Emotion at Work, Job Satisfaction, The Measurement of Job Satisfaction, The Concept of Commitment, Moods, Emotions, Attitudes, and Behavior. Values - definition, types of values, values across cultures, values and behavior.
Unit 5	**Psychological Factors in Work Design:** Approach to work design, Historical perspective, Human information processing, Natural and manmade effect, psychological dimensions of work, Job enrichment, Quality of work life, Future of work design.

Text and Reference Books

1. Newstrom, J. W, and Davis, K., Organizational Behavior – Human Behavior at Work, Tata McGraw Hill Publishing Co.Ltd, New Delhi.
2. Scultz, D. P. and Schultz, E.S, Psychology and Work Today, Mac Millan Publishing Company, New York
3. Blum, M. L and Naylor, J.C., Industrial Psychology, CBS Publishers and Distributors, New Delhi.
4. Ghosh, P.K and Ghorpade M.B, Industrial Psychology, Himalaya Publishing House, Bombay.

Mapping of Course outcomes with Program outcomes and Program Specific Outcomes:

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	1					3				1				
CO2		2		1										
CO3	2									2				
CO4		3	2		3									
CO5	1													

1 – Low, 2 – Medium, 3 – High

Assessment:

ISE 1: 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	5	5	3	20
K2	Understand	5	5	3	20
K3	Apply	5	5	4	20
K4	Analyze				
K5	Evaluate				
K6	Create				
Total Marks 100		15	15	10	60

Assessment table:

Assessment Tool					
	CO1	CO2	CO3	CO4	CO5
ISE I (15 Marks)	5	10			
ISE II (15 Marks)	10	5			
ISE III (10 Marks)	5	5			
ESE Assessment (60 Marks)	12	12	12	12	12

MEOEC2011: Engineering Economics		
Teaching Scheme	**Examination Scheme**	
Lectures: 3 Hrs. / Week	ISE I	15 Marks
Credits: 3	ISE II	15 Marks
	ISE III	10 Marks
	End Semester Examination	60 Marks

Course Objectives:

1. Introduction to engineering economics
2. Understand profit loss philosophy and break-even analysis
3. Understand various aspects of costing, budgeting and payback period.
4. Understanding cost control and various expenses.
5. Understanding Measurement of Cost of Capital and methods of cost allocations.

Course Outcomes:

After completing the course students will able to

Course Outcomes	
CO1	Apply concepts of economic analysis to an industry.
CO2	Understand fund flow analysis, break even analysis, ratio analysis
CO3	Apply probabilistic risk analysis methods, standard costing, marginal costing
CO4	Understand cost control, elements of cost
CO5	Understand budgeting, cost of capital, cost allocation

Detailed Syllabus:

Unit 1	**Introduction:** Engineering and Economics, Definition and scope of Engineering Economics, Time value of money: Simple and compound interest, Time value equivalence, Compound interest factors, Cash flow diagrams, Calculation, Calculation of time –value equivalences. Present worth comparisons, Comparisons of assets with equal, unequal and infinite lives, comparison of deferred investments, Future worth comparison, payback period comparison
Unit 2	**Fund flow analysis:** concepts, objectives, techniques of Fund flow statement. Ratio analysis: Classification of ratios, structural group, standards for comparison limitations of Ratio analysis, returns on investment and integral ratio. Cost volume profit analysis: mechanics of break even chart, profit planning and break-even analysis, margin of safety.
Unit 3	**Standard Costing:** - Concept, Development and use of Standard Costing, Budget and Budgetary Control, Variance Analysis. Marginal Costing: - Use of Marginal Costing in Decision Making. Allocation of Resources: Capital Budgeting: Control of Capital Expenditure, Evaluation Process – Payback approach, Accounting of Rate of Return, Present Value Method Vs Internal Rate of Return.
Unit 4	**Introduction to Cost Control**, Significance for Engineers, Limitations of Financial Accounting, Corporate Objectives, Profitability and other objectives, Product, Services and Market Mix. Elements of Cost: - Material, Labor, Expenses, Overheads, Direct and Indirect Cost, Fixed and Variable Cost, other classifications
Unit 5	**Cost of Capital:** Relevant Cost, Measurement of Cost of Capital, Cost of Debt, Preference Shares, Equity Shares, Internal Financing, Dividends, Cost of Retained

	Earnings Concept Cost Allocation: - Cost Accumulation and Allocation, Allocation of cost-of-Service Departments – Reciprocal Method, Allotting cost from one department to other, Depreciation, Various methods for calculation.

Text and Reference Books

1. Prasad N. K., Cost Accounting Book Syndicate Pvt. Ltd.. Kolkata
2. C. B. Gupta, Fundamentals of Business, Sultan Chand & Co
3. Henry M. Stenier, engineering economics Principles, Mc Grow hill Publication.
4. P. A. Samualson, Economics, Mc Graw hill International.
5. Colin Drury, management and Cost Accounting, English Language Book Society, Chapman & Hall Landon.
6. Basu S.K., Sahu K.C and Rajiv B, Industrial Organization and Management –. PHI New Delhi.

Mapping of Course outcomes with Program outcomes and Program Specific Outcomes:

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	1	2												2
CO2	1	1	2	2										2
CO3	1	1	2	2										2
CO4	1	2	2	2										2
CO5	1	2	2											2

1 – Low, 2 – Medium, 3 – High

Assessment:

ISE 1: 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 levels no.	Knowledge levels	ISE I	ISE II	ISE III	ESE
K1	Remember	03	03	02	10
K2	Understand	04	04	02	10
K3	Apply	03	03	02	20
K4	Analyze	05	05	02	20
K5	Evaluate	00	00	02	00
K6	Create	00	00	00	00
Total Marks 100		15	15	10	60

Assessment table:

Assessment Tool	K1 to K4	K1 to K4	K1 to K4	K1 to K4	K1 to K5
	CO1	CO2	CO3	CO4	CO5
ISE I (15 Marks)	08	07			
ISE II (15 Marks)			08	07	
ISE III (10 Marks)	02	02	02	02	02
ESE Assessment (60 Marks)	12	12	12	12	12
Total Marks 100	22	21	22	21	14

MEOEC2012: Ethical Values		
Teaching Scheme	**Examination Scheme**	
Lectures: 3 Hrs. / Week	ISE I	15 Marks
Credits: 3	ISE II	15 Marks
	ISE III	10 Marks
	End Semester Examination	60 Marks

Course Objectives:

1. Development of a positive character, responsible citizen, a compassionate and empathetic being.
2. Promoting a sustainable life style for the individual, community and man kind
3. Developing a sense of right and wrong leading to practical ethical behaviour
4. Inculcating a positive work culture respecting professional ethics.

Course Outcomes:

After completing the course students will able to

Course Outcomes	
CO1	Identify and analyze an ethical issue and Understanding virtues of volunteerism.
CO2	Identify the multiple ethical interests at stake in a real-world situation or practice
CO3	Assess their own ethical values and the social context of problems
CO4	Understand what makes a particular course of action ethically defensible
CO5	To use science and technology for preservation of environment and its sustainable development.

Detailed Syllabus:

Unit 1	**Introduction:** General introduction on Ethics and Values, Morals, Values and Ethics, Integrity, Work Ethic, Service learning, Civic Virtue, Respect for others, Living Peacefully, Caring–Sharing–Honesty-Courage-Cooperation Commitment–, Empathy, Self Confidence Character, Spirituality, Concepts and facets of Volunteerism and Leadership.
Unit 2	**Engineering ethics:** Senses of Engineering Ethics, Variety of moral issued, Types of inquiry, Moral dilemmas, Moral autonomy, Kohlberg's theory-Gilligan's theory, Consensus and controversy, Models of professional roles, Theories about right action, Self-interest- ethical interests at stake in a real-world situation, Customs and religion, Uses of Ethical theories, Valuing time, Co-operation–Commitment
Unit 3	**Engineering as social experimentation:** Framing the problem, Determining the facts Codes of Ethics, Clarifying Concepts, Application issues, Common Ground-General Principles, Utilitarian thinking respect for persons
Unit 4	**Engineers' responsibility for safety and risk:** Safety and risk, Assessment of safety and risk–Risk benefit analysis and reducing risk Safety and the Engineer-Designing for the safety-Intellectual Property rights (IPR)
Unit 5	**Environmental Ethics:** Types of Ecological Values, Environmental Values vis a vis conserving Nature, Equitable use of Resources, Role of Individual in the conservation of resources for future generation, Bio-Ethics-Genetic manipulation in plants and animals for benefit of society and cruelty against animal

Text and Reference Books

1. M. Govindarajan, S. Natarajananad, V. S. Senthil Kumar, "Engineering Ethics includes Human Values", PHI Learning Pvt. Ltd
2. Harris, Pritchard and Rabins, "Engineering Ethics", CENGAGE Learning, India Edition.
3. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw-Hill.
4. Prof. A. R. Aryasri, Dharanikota Suyodhana, "Professional Ethics and Morals", Maruthi Publications.
5. Alavudeen, R. Kalil Rahman and M. Jayakumaran, "Professional Ethics and Human Values", Laxmi Publications.
6. PSR Murthy, "Indian Culture, Values and Professional Ethics", BS Publication

Assessment:

ISE 1: 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

Mapping of Course outcomes with Program outcomes and Program Specific Outcomes:

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1								2				1		
CO2	1		1					2						
CO3						1	1	2						1
CO4						1	1	2						1
CO5						1	2	2						

1 – Low, 2 – Medium, 3 – High

Assessment pattern:

Assessment pattern levels no.	Knowledge levels	ISE I	ISE II	ISE III	ESE
K1	Remember	06	06	04	25
K2	Understand	06	06	04	25
K3	Apply	03	03	02	10
K4	Analyze	00	00	00	00
K5	Evaluate	00	00	00	00
K6	Create	00	00	00	00
Total Marks 100		15	15	10	60

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 (15 Marks)	08	07			
ISE II (15 Marks)			08	07	
ISE III (10 Marks)	02	02	02	02	02
ESE Assessment (60 Marks)	12	12	12	12	12
Total Marks 100	22	21	22	21	14

MEOEC2020: Total Quality Management		
Teaching Scheme	**Examination Scheme**	
Lectures: 3 Hrs. / Week	ISE I	15 Marks
Credits: 3	ISE II	15 Marks
	ISE III	10 Marks
	End Semester Examination	60 Marks

Course Objectives:

1. To get familiarized with the basic concept and framework of Total Quality management
2. To Understand the contribution of Quality Gurus in TQM Journey
3. To grasp the nature and importance of various components that constitute TQM
4. To describe and discuss the role of techniques used in TQM
5. Illustrating the fundamental principles and practices of quality and performance excellence

Course Outcomes:

After completing the course students will able to

Course Outcomes		Bloom's Taxonomy Level	Unit
CO1	Describe the concepts of Quality, TQM and benefits of TQM	K1	1,2,3,4,5
CO2	define, and document a process with the aid of control charting and statistics.	K2	1,2,3,4,5
CO3	Outline the evolution of the TQM philosophy	K2	1,2
CO4	Understand the principles, practices and applications of quality management for product or service design and performance monitoring	K2	2,3,4,5
CO5	Explain quality standards and need for standardization	K3	1,2,4,5

Detailed Syllabus:

Unit 1	**Introduction to TQM** Customer orientation, continuous improvement, Quality, Productivity and flexibility, approaches and philosophies of TQM, Quality Awards, Strategic Quality Management, TQM and corporate culture
Unit 2	**Total Quality Control** Basic analytical tools check sheets, Histograms, Pareto charts, Cause and Effect diagrams, flow charts, scatter diagrams, run charts, Cost of Quality, Quality cost measurement, Reliability and failure analysis
Unit 3	**Quality Circles** Introduction, implementation, formation, intangible impact of quality circle, inhibiting factors Kaizen: Introduction, the Japanese style of management & Kaizen implementation, modeling kaizen process and benefits, Problem solving in TQM: Brain storming
Unit 4	**Just in Time Manufacturing** Introduction, advantages, approach to quality, importance of KANBAN in JIT, Introduction to ISO

Unit 5	**Business Process Reengineering** Reengineering, definition, strategic value-added process, reengineering trends, incremental improvement program, stages of reengineering, preparation identification, vision, technical and social design, transformation, Differentiation of BPR, TQM techniques and JIT

Text and Reference Books

1. W. Edward Deming, 'Out of crisis', MIT publishing
2. Ishikawa & Lu, 'What is Total Quality Control? The Japanese way', Prentice Hall
3. D. J. Tally, 'Total Quality Management', ASQC Quality Press
4. A. V. Feigenbaum, 'Total Quality Control', McGraw Hill International Editions, USA
5. J. M. Juran, 'Quality Control Handbook', McGraw Hill Book Company, USA
6. Masaaki Imai, 'Kaizen: The key to Japan's Competitive Success', McGraw Hill International Editions, USA

Mapping of Course outcomes with Program outcomes and Program Specific Outcomes:

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	1		1				2			1			2	
CO2		2			1			1				2	2	1
CO3			1			1					1			1
CO4			2		2		2		1				1	1
CO5												2	1	

1 – Low, 2 – Medium, 3 – High

Assessment:

ISE 1: 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	ISE1	ISE2	ISE3	End Semester Examination
K1	Remember	5	5		20
K2	Understand	5	5	5	20
K3	Apply	5	5	5	20
K4	Analyse				
K5	Evaluate				
K6	Create				
Total Marks 100		15	15	10	60

MEOEC2021: Industrial Management		
Teaching Scheme	**Examination Scheme**	
Lectures: 3 Hrs. / Week	ISE I	15 Marks
Credits: 3	ISE II	15 Marks
	ISE III	10 Marks
	End Semester Examination	60 Marks

Course Objectives:

1. Understand the fundamental concepts, functions, nature and evolution of Management.
2. Understand the basic principles of management, designing organization structures, operations
3. Recognize and overcome obstacles to creative problem-solving
4. Able to improve different structures of organization and problem solving
5. Able to understand CPM and PERT

Course Outcomes:

After completing the course students will able to

Course Outcomes		Bloom's Taxonomy Level	Unit
CO1	Explain the concepts of management and explore the management practices in their domain area within society	K1	1,2,3,4,5
CO2	Evaluate different types of organizational structures and Design them	K2	1,2,3,4,5
CO3	Understand the different structures of organization and problem solving	K2	1,2
CO4	Understand the reason for the change and how it aligns with the organization's overall goals	K2	2,3,4,5
CO5	Use the techniques of PERT/CPM in project.	K3	1,2,4,5

Detailed Syllabus:

Unit 1	**Theories of Management:** Scientific Management (Taylor and the Scientific Management Movement), Classical Theory (Fayol, Urwick, Gulick and others) Bureaucratic Theory (Weber and his critics). Ideas of Mary Parker Follett and C.I. Barnard; Human Relations School (Elton Mayo and others). Behavioral Approach, Systems approach.
Unit 2	**Administrative Behavior:** Decision making with special reference to H. Simon, communication and control, leadership theories. Theories of motivation (Maslow and Herzberg), Contemporary industrial practices
Unit 3	**Organization:** Hierarchy, Principles of organization- Unity of command, Span of control, Authority and Responsibility, Co-ordination, Centralization and Decentralization, Delegation, Supervision, Types of organizations, structures, Contemporary industrial practices
Unit 4	**Organizational Change:** Introduction, Resistance to Change, Behavioural Reactions to Change, Approaches Or Models to Managing Organisational Change.
Unit 5	**Project Management & Network Modelling:** Critical Path Method (CPM), Problems, Program Evaluation and Review Technique (PERT), PERT Problems.

Text and Reference Books

1. Besterfield DH, Total Quality Management, Pearson education
2. Russel, R S, Taylor BW, Operations Management, Pearson education
3. Jocobs, C A Production and operations management, TMH
4. Mitra, A, Fundamentals of Quality control and improvement, John Willey & Sons

Mapping of Course outcomes with Program outcomes and Program Specific Outcomes:

Course Outcomes	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	1			2						2			2	
CO2		1				2					1		2	1
CO3	2		1								1	2		
CO4		1			2					2			1	1
CO5	2										2		1	

1 – Low, 2 – Medium, 3 – High

Assessment:

ISE 1: 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	ISE1	ISE2	ISE3	End Semester Examination
K1	Remember	5	5		20
K2	Understand	5	5	5	20
K3	Apply	5	5	5	20
K4	Analyse				
K5	Evaluate				
K6	Create				
Total Marks 100		15	15	10	60

MEOEC2022: Manufacturing Management		
Teaching Scheme	**Examination Scheme**	
Lectures: 3 Hrs. / Week	ISE I	15 Marks
Credits: 3	ISE II	15 Marks
	ISE III	10 Marks
	End Semester Examination	60 Marks

Course Objectives:

1. To manage organizations, units, groups (teams) of employees, projects and networks;
2. To develop a corporate strategy;
3. To possess skills in production analysis, highlighting the strengths and weaknesses of the manufacturing enterprise;
4. To analyze the relationship between functional departments and workshops in order to prepare balanced management decisions;

Course Outcomes:

After completing the course students will able to

Course Outcomes	
CO1	Recognize the fundamental concept of operations Management, Strategy and Productivity
CO2	Understand Quality Management and quality control
CO3	Understanding Planning, Forecasting and New product development
CO4	To analyze the relationship between functional departments and workshops in order to prepare balanced management decisions
CO5	To master the mechanisms of automation of production processes.

Detailed Syllabus:

Unit 1	Introduction to Operations Management; Types and Characteristics of Manufacturing and Service Systems; Product Design
Unit 2	Nature of Quality; Evolution of Quality Management; Modern Quality Management; Total Quality Management; Statistical Concepts in Quality Control
Unit 3	Planning in production management. Planning and organization of the cycle of creation and development of new products and technologies. R&D organization. Requirements for scientific and technical development. Evaluation of the effectiveness of R&D.
Unit 4	The personnel structure of the enterprise, HR functions, HR management system, its elements, Personnel policy of the enterprise.
Unit 5	Innovative aspects of production management, Technology transfer and commercialization.

Text and Reference Books

1. William J. Stevenson, Operations Management, McGraw-Hill
2. E S Buffa and Rakesh K Sarin, Modern Production/ Operations Management, Wiley
3. Richard B Chase, F Robert Jacobs, Operations Management for Competitive Advantage, McGraw-Hill Education
4. Norman Gaither and Greg Frazier, Operations Management, South-Western

Mapping of Course outcomes with Program outcomes and Program Specific Outcomes:

Course Outcomes	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	1	2	1					1	1		1	1		1
CO2	3	1												1
CO3	1			1							2			
CO4	3	1							1			2		1
CO5	1		1	1										

1 – Low, 2 – Medium, 3 – High

Assessment:
ISE 1: 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	ISE1	ISE2	ISE3	End Semester Examination
K1	Remember	5	5		20
K2	Understand	5	5	5	20
K3	Apply	5	5	5	20
K4	Analyse				
K5	Evaluate				
K6	Create				
Total Marks 100		15	15	10	60

MEMDM5001 - Photovoltaic Energy System		
Teaching Scheme	**Examination Scheme**	
Lectures: 03 Hrs. / Week	ISEI	15 Marks
Credits: 03	ISEII	15 Marks
	ISEIII	10 Marks
	End Semester Examination	60 Marks

Course Objectives:

1. To provide knowledge on the types, operation, and selection criteria of inverters used in PV systems.
2. To analyze and optimize the performance of PV systems for maximum efficiency.
3. To learn the key design considerations for both standalone and grid-connected PV systems.
4. To evaluate the environmental impact of PV systems throughout their lifecycle.
5. To explore recent innovations in PV materials and manufacturing processes.

Course Outcomes: Upon successful completion of the course, students will be able to:

Course Outcomes		Bloom's Taxonomy Level
CO1	Explain the working principles and characteristics of photovoltaic cells and modules.	K1, K2
CO2	Analyze and design PV system components, including inverters, charge controllers, and batteries.	K3
CO3	Evaluate performance metrics such as efficiency, reliability, and economic viability of PV systems.	K4
CO4	Apply software tools for simulation, optimization, and monitoring of PV systems.	K3, K4
CO5	Demonstrate knowledge of emerging trends and innovations in PV technology.	K1, K2, K3

Detailed Syllabus:

Unit 1	**Introduction to Photovoltaic System:** Overview of renewable energy sources, Basics of photovoltaic effect, Types and characteristics of photovoltaic cells, PV modules: Construction and working principles, Solar radiation basics and measurement.
Unit 2	**PV System Components:** Inverters: Types, operation, and selection criteria, Charge controllers: Types and functions, Batteries: Types, characteristics, and sizing, Balance of system components.
Unit 3	**PV System Design:** Design considerations for standalone and grid-connected PV systems, Performance analysis and optimization techniques, Economic analysis: Cost-benefit analysis, payback period, and ROI, Environmental impact assessment of PV systems.
Unit 4	**Installation and Maintenance of PV Systems**: Installation practices and safety considerations, Maintenance strategies: Preventive and corrective measures, Troubleshooting common issues in PV systems, Case studies and real-world applications.

Unit 5	**Emerging Trends in PV Technology**: Innovations in PV materials and manufacturing processes, Integration of PV systems with energy storage solutions, Smart grid technologies and their impact on PV integration, Policy and regulatory aspects influencing PV deployment.

Text and Reference Books

1. "Photovoltaic Systems Engineering" by Roger Messenger and Jerry Ventre
2. "Solar Photovoltaics: Fundamentals, Technologies and Applications" by Chetan Singh Solanki
3. "Photovoltaics: Design and Installation Manual" by Solar Energy International
4. "Solar Energy: The Physics and Engineering of Photovoltaic Conversion" by Arno Smets, Klaus Jäger,
5. https://archive.nptel.ac.in/courses/117/108/117108141
6. https://archive.nptel.ac.in/courses/115/107/115107116/
7. https://archive.nptel.ac.in/courses/115/103/115103123/

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

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	3			2	2								1	
CO2		2	2		2									
CO3			1							2				
CO4							1							
CO5	3	2		2	2							1		

Assessment:

- ISE I: Based on assignments, quizzes, and presentations on Units 1 and 2.
- ISE II: Class test focusing on Units 3 and 4.
- ISE III: Based on all units
- ESE: Comprehensive examination covering all units.

Assessment pattern:

Assessment pattern levels no.	Knowledge levels	ISE I	ISE II	ISE III	ESE
K1	Remember	5	5	2	18
K2	Understand	5	5	2	18
K3	Apply	3	3	3	12
K4	Analyze	2	2	3	12
K5	Evaluate				
K6	Create				
Total Marks 50		**15**	**15**	**10**	**60**

Assessment table:

Assessment Tool	K1, K2	K3	K4	K3, K4	K1, K2, K3
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
ISE I (15 Marks)	3	3	3	3	3
ISE II (15 Marks)	3	3	3	3	3
ISE III (10 Marks)	2	2	2	2	2
ESE (30 Marks)	**12**	**12**	**12**	**12**	**12**
Total Marks 50	**20**	**20**	**20**	**20**	**20**

MEMDM5002: Photovoltaic Energy System Lab		
Teaching Scheme	**Examination Scheme**	
Practical: 02 Hrs. / Week /Batch	ESE	25 Marks
Credits: 01		

Course Outcomes

After completion of this course, students will be able to:

Course Outcomes	
CO1	Identify and explain the function of various components used in solar PV systems, including PV cells, modules, inverters, and charge controllers.
CO2	Conduct experiments to measure and analyze parameters such as solar irradiance, PV module efficiency, and performance characteristics under different conditions.
CO3	Demonstrate knowledge of safety protocols and practices specific to PV installations, including handling PV modules, electrical connections, and site safety.
CO4	: Prepare comprehensive technical reports and presentations based on findings from PV system installations and performance evaluations.

List of Experiments

No.	Title of the Experiment	Objective	Skill / Knowledge Level	Related COs
1	Introduction to Solar Radiation Measurement	Understand the basics of solar radiation measurement using pyranometers and solarimeters.	K2	CO1 and CO4
2	Characterization of PV Cells	Study the characteristics of different types of photovoltaic cells (monocrystalline, polycrystalline, thin-film).	K3	CO2 and CO4
3	PV Module Construction and Working Principles	Disassemble and analyze a PV module to understand its construction and working principles.	K3	CO2 and CO4
4	PV System Design and Simulation	Design a small-scale PV system based on given specifications using simulation software.	K3	CO3 and CO4
5	PV System Installation and Commissioning	Install and commission a PV system on a test platform or rooftop, including mounting, wiring, and safety procedures.	K3	CO3 and CO4
6	PV System Troubleshooting and Maintenance	Identify common issues in PV systems and perform troubleshooting techniques. Discuss maintenance practices.	K2	CO4
7	Safety Procedures in PV System Installation	Demonstrate and discuss safety protocols and procedures during the installation and maintenance of PV systems.	K3	CO3 and CO4

No.	Title of the Experiment	Objective	Skill / Knowledge Level	Related COs
8	Calculate PV Module Efficiency	Calculate the efficiency of a PV module by measuring its electrical output under standard test conditions (STC).	K2	CO2 and CO4
9	Visit to a Solar PV Installation Site	Visit a commercial or residential solar PV installation site. Observe and report on the installation, operation, and challenges faced.	K2	CO1, CO3, CO4

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

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

Assessment: ISE I

- The ISE I will consist of submitting a comprehensive report for each experiment, including observations, calculations, and analysis.

End Semester Evaluation

- The End Semester Evaluation will include a viva voce to assess understanding of practical concepts and applications.

Assessment Pattern:

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

MEMDM5003: Energy Management		
Teaching Scheme	**Examination Scheme**	
Lectures: 03 Hrs. / Week	ISE I	15 Marks
Credits: 03	ISE II	15 Marks
	ISE III	10 Marks
	End Semester Examination	60 Marks

Course Objectives:

1. To acquire basic knowledge of energy conservation, audit, and management.
2. To evaluate energy saving & conservation in different utilities.
3. To understand efficient heat & electricity utilization, saving, and recovery in different thermal and electrical systems.
4. To understand energy costs and to prepare energy management reports.

Course Outcomes:

After completing the course students will able to

(K1-Remembe, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6-Create)

	Course Outcomes	**Bloom's Taxonomy Level**
CO1	Understand the classification and scenario of energy including related acts and policies.	K1, K2
CO2	Conduct energy audits and manage energy costs effectively.	K3
CO3	Evaluate energy efficiency in thermal utilities such as boilers, steam systems, and furnaces.	K2, K3
CO4	Identify and implement energy-saving opportunities in thermal utilities like heat exchangers, HVAC systems, and building systems.	K4
CO5	Estimate energy losses in electrical utilities and manage electrical loads effectively.	K4

Detailed Syllabus:

Unit 1	**Unit 1: Energy Scenario** Classification of Energy, Indian energy scenario, Energy consumption (domestic, industrial, and other sectors), Energy needs, energy intensity, energy pricing, energy security, Energy conservation and its importance, Energy Conservation Act 2001 and related policies, Schemes of Bureau of Energy Efficiency (BEE) including Designated consumers, Designated Agencies, Duties and responsibilities of Energy Manager, Electricity Act 2003, Air pollution, climate change, UNFCC, Clean Development Mechanism
Unit 2	**Unit 2: Energy Management & Audit** Definition, energy audit, need, types of energy audit, Energy management and understanding energy costs, Benchmarking, energy performance, maximizing system efficiencies, optimizing energy requirements, Fuel and energy substitution, Energy audit instruments and metering, Energy monitoring and targeting, pinch technology, energy analysis, and mass balance

Unit 3	**Unit 3: Energy Efficiency in Thermal Utilities - I** Boilers: Performance evaluation, analysis of losses, energy conservation opportunities, boiler efficiency calculation, evaporation ratio, and efficiency for coal, oil, and gas Steam System: Properties of steam, assessment of steam distribution losses, steam leakages, condensate and flash steam recovery system, thermo-compressor, steam pipe insulation, condensate pumping, steam dryers Furnaces: Performance evaluation of a furnace, insulation, and refractories, insulation-types, and application, economic thickness of insulation
Unit 4	**Unit 4: Energy Efficiency in Thermal Utilities - II** Waste Heat Recovery: Classification, advantages, and applications, Cogeneration: Definition, need, application, advantages, classification, saving potentials Energy saving opportunities in fans, pumping system, cooling towers, and compressed air systems, air conditioners, cold storage refrigeration, and humidification system, heat pump applications, HVAC, and refrigeration system Evaluation of heat loss and heat gain in building systems, thermal design building systems, evaluation of window and glazing, solar simulation of building systems, energy budget
Unit 5	**Unit 5: Estimation of Energy Loss in Electrical Utilities** Introduction to electrical measurement: Current, Voltage, Frequency, Active power, Reactive power, Power factor, Apparent power, Active energy, Instrumentation: Lux meter, Infrared thermometer, Leak detector, Combustion analyzer, Radiation pyrometer, Wind anemometer, Power meter, Thermo-graphic camera, Power analyzer, Flue gas analyzer, Thermo-hygrometer, Electrical load management, Preparation of project report on energy management and audit, case studies

Text and Reference Books

1. "Energy Management Handbook" by Wayne C. Turner and Steve Doty
2. "Energy Management Principles" by Craig B. Smith and Kelly E. Parmenter
3. Handbooks of Bureau of Energy Efficiency (BEE) in India
4. https://onlinecourses.nptel.ac.in/noc22_hs105/preview
5. https://archive.nptel.ac.in/courses/112/105/112105221
6. https://onlinecourses.nptel.ac.in/noc23_hs69/preview

Mapping of Course outcomes with Program outcomes:

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

1 – Low, 2 – Medium, 3 – High

Assessment: ISE I, II, III (TA) & ESE

TA: Students will perform one or more of the following activities

1. Surprise Test
2. Assignment
3. Quiz
4. Any other activity suggested by course coordinator

Assessment Pattern:

Assessment Pattern Level No.	**Knowledge Level**	**ISE I (Class Test)**	**ISE II (Class Test)**	**ISE III (Teacher Assessment)**	**End Semester Examination**
K1	Remember	5	5	2	6
K2	Understand	5	5	2	6
K3	Apply	5	5	2	30
K4	Analyze			2	9
K5	Evaluate			2	9
K6	Create				
Total Marks 100		15	15	10	60

MEMDM6001: Metrology and Quality Control		
Teaching Scheme	**Examination Scheme**	
Lectures: 3 Hrs. / Week	ISE I	15 Marks
Credits: 3	ISE II	15 Marks
	ISE III	10 Marks
	End Semester Examination	60 Marks

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

Course Outcomes:
After completing the course students will able to

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

Detailed Syllabus:

Unit 1	**Metrology:** Definition and concept of metrology and standardizations, Standards of linear measurement, Line standard, End standard and wavelength standard, Traceability, Reliability. Accuracy and Precision **Limits, Fits and Gauges:** **Limits**: Tolerances, different ways of expressing accumulation, relationship between tolerances and cost, interchangeability, selective assembly maximum and minimum metal conditions, Indian standard (IS 919-1963) **Fits:** Terminology for limits and fits, types of fits, hole basis system, shaft basis system,selection of fits, types of assemblies like trial and error, interchangeable assembly, **Gauges**: Plain gauges, ring gauges, snap gauges, adjustable gap gauges, control and profile gauges, material for gauges, Gauge design: Taylor's principle, gauge maker's tolerance, wear allowances, numerical on gauge design. Industrial applications of limits, fits and gauges.
Unit 2	**Comparators:** Introduction, types of comparators, construction and working of different types of comparators like mechanical, optical, electric, and pneumatic. Industrial applications of comparators. **Angular measurements:** Venire bevel protector, universal bevel protector, sine bar, angle gauges, optical instrument like auto collimator, angle dekkor, and industrial applications of angular measuring instruments. **Measurement and testing of gears:** Sources of errors in manufacturing gears, gear measurement, gear rolling tests.

Unit 3	**Measurement of surface finish:** Definition, terminology, methods of measuring surface finish by using surface roughnesstester **Metrology of screw threads**: Screw threads terminology, error in threads and their effects, measurements of variouselements of threads. **Measurement by using light-wave interference:** Interference of two rays, light source for interferometry, interferometry applied to flatness,concave and convex testing.
Unit 4	**Quality Control:** **Quality:** meaning of quality of product & services, Quality characteristics, Quality of design, Quality of conformance, Quality of performance, Concept of reliability, Cost of quality, Value of quality, Quantity assurance, Cost of rework & repair, Quality Control & Inspection, Inspection stages. ISO 9000 Series & other **standards:** Concept, ISO 9000 series quality standards, QS14000, Standards in general, necessity of ISO 9000 certification and procedure.
Unit 5	**Statistical Quality Control** – Meaning and importance of SQC, Variable and attribute Measurement. control charts – inherent and assignable sources of variation, control chartsfor variables $\bar{X}$ & R charts, control charts for attributes P and C charts, process capability of machine, determination of statistical limits, different possibilities, Rejection area,statistically capable and incapable processes, Cp, Cpk. **Acceptance Sampling** – Concept, Comparison with 100% inspection, Different types of sampling plans, with merits and demerits, OC curve, It's importance and significance, Producer's risk, Consumer's risk, AQL, AOQL, IQL, LTPD

Text and Reference Books

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

Mapping of Course outcomes with Program outcomes and Program Specific Outcomes:

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	1	2			3	1				1		1	1	
CO2	3				2	1				1			1	
CO3	1				1	1				1		1	1	
CO4	3					1				1				1
CO5	1	1			2	1						1		

1 – Low, 2 – Medium, 3 – High

Assessment:

ISE 1: 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 levels no.	Knowledge levels	ISE I	ISE II	ISE III	ESE
K1	Remember	5	5		20
K2	Understand	5	5	5	20
K3	Apply	5	5	5	10
K4	Analyze				
K5	Evaluate				10
K6	Create				
Total Marks 100		15	15	10	60

Assessment table:

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

MEMDM6002: Metrology and Quality Control Lab		
Teaching Scheme	**Examination Scheme**	
Practical: 02 Hrs. / Week	End Semester Examination	25 Marks
Credits: 01		

Course description:
To familiarize students to apply knowledge of various tools and techniques used to determine geometry and dimensions of components in engineering applications. In addition to develop the ability to perform experiments, as well as to analyze and interpret data, also to develop the ability to design gauges to meet desired needs within realistic constraints and understanding of Quality Control techniques and its applications in engineering industries.

Course Outcomes:

After completion of this course students will be able to:

	Course Outcomes
CO1	To apply knowledge of appropriate measuring instruments, gauges or comparators used to determine geometry and dimensions of components in engineering applications.
CO2	Illustrate selection and use of comparators, angular measurement and gear measurement.
CO3	Summarize the methods of measurement of surface roughness and screw thread. Testing flatness, concave and concave surfaces by light wave interference.
CO4	Recall the concept of Quality Control and ISO 9000 certification.
CO5	Construct the control charts and recommend acceptance sampling appropriately.

List of the Experiments
Student shall perform minimum eight experiments of the following.

Sr. No	Title of the Experiment	Skill or knowledge level
1	Measurements of dimensions of components by using linear measuring instruments.	K1
2	Inspection of components by limit gauges for checking tolerances.	K3
3	Use of various types of comparators for comparison of standards with actual components.	K1
4	Measurements of angles of components by using various angular measuring instruments.	K1
5	Testing of gears by gear rolling tester	K3
6	Measurements of surface roughness of components by using surface roughness measuring instrument.	K2
7	Measurements of major diameter, minor diameter and effective diameter by using one wire, two wire and three wire methods.	K2
8	Demonstration of interferometry applied to test flatness, concave	K5

	and convex surfaces.	
9	Demonstration of Co-ordinate Measuring Machine and 3 D Scanner for measuring dimensions of a component.	K5
10	Construction of control charts for variables and attributes used for SQC.	K5

Mapping of Course outcomes with Program outcomes and Program Specific Outcomes:

Course Outcomes	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	2	1	1	1					1			2	2	
CO2	3	1			1				2			2	2	
CO3	2		1		1				1			2	2	
CO4	2			1					2			2	2	
CO5	2								1			2	2	

1 – Low, 2 – Medium, 3 – High

Assessment:

End Semester Evaluation

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

Assessment Pattern:

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

MEMDM6003: Production Technology		
Teaching Scheme	**Examination Scheme**	
Lectures: 3 Hrs. / Week	ISE I	15 Marks
Credits: 3	ISE II	15 Marks
	ISE III	10 Marks
	End Semester Examination	60 Marks

Course Objectives:

The objectives of offering this course are to-

1. Introduce the student to processes and equipment utilized in the manufacturing environment.
2. Compare and contrast different material types and their application.
3. Explain the concepts of production monitoring and control processes.
4. Explain different forms of production logistics in a manufacturing process.

Course Outcomes:

On successful completion of this course, students will be able to-

After completing the course students will able to

Course Outcomes	
CO1	Explain the operations and capabilities of machines used in manufacturing.
CO2	Describe concept of jigs and fixture design
CO3	Understand working principal of various non-conventional manufacturing process.
CO4	Interpreted concept of Work System Design and application.
CO5	Classify different plant playout used in industries.

Detailed Syllabus:

Unit 1	Machine Tools and Machining: Basic machine tools like centre lathe, milling machine, and drilling machine machining processes - turning, taper turning, thread cutting, drilling, boring, milling, gear cutting, thread production, grinding; geometry of single point cutting tools, chip formation, cutting forces, specific cutting energy and power requirements, Merchant's analysis; basis of selection of machining parameters; tool materials, tool wear and tool life, economics of machining, cutting fluids,
Unit 2	Jigs, fixtures– principles, applications, types and design, location and locating devices, bushing types and applications (linear, renewable, etc) and clamps;
Unit 3	Non-traditional Manufacturing: Principles, applications, effect of process parameters on MRR and product quality of non-traditional machining processes – USM, AJM, WJM, AWJM, EDM and Wire cut EDM, LBM, EBM, PAM, CHM, ECM. Computer Integrated Manufacturing: Basic concepts of CAD .
Unit 4	Work System Design: Taylor's scientific management, productivity – concepts and measurements; method study, micro-motion study, principles of motion economy; work measurement –time study, work sampling, standard data, PMTS; ergonomics; job evaluation, merit rating,
Unit 5	Facility Design: Facility location factors and evaluation of alternate locations; types of plant layout and their evaluation; computer aided layout design techniques; assembly line balancing; materials handling systems.
Text Books:	

1. P. N. Rao, Manufacturing Technology Vol-1,.
2. G. Boothroyd, Fundamentals of Metal Cutting Machine Tools, TMH.
3. Production Technology, HMT Publication,
4. A. Bhattacharya, Metal Cutting Theory & Practice, Central Book Publisher, Calcutta
5. A. Ghosh and A. K. Mallik, Manufacturing Science, Wiley Eastern.
6. Maslov, Manufacturing Process, Mir Publishers

Mapping of Course outcomes with Program outcomes and Program Specific Outcomes:

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	2	-	3	1										
CO2	2	3	-						2					
CO3	1	-	2											1
CO4		2		2										
CO5	1		2											

1 – Low, 2 – Medium, 3 – High

Assessment:

ISE 1: 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	Test I	Test II	Teachers Assessment/ Assignment	End Semester Examination
K1	Remember	06	06	04	25
K2	Understand	06	06	04	25
K3	Apply	03	03	02	10
K4	Analyze	00	00	00	00
K5	Evaluate	00	00	00	00
K6	Create	00	00	00	00
Total Marks 100		15	15	10	60

Assessment table

Assessment Tool	K1 to K4	K1 to K4	K1 to K4	K1 to K4	K1 to K4
Cos	CO1	CO2	CO3	CO4	CO5
Class Test I(15Marks)	08	07			
Class Test II(15Marks)			08	07	
Teachers Assessment (10 Marks)	02	02	02	02	02
ESE Assessment (60 Marks)	12	12	12	12	12

MEINT2001: Internship		
Teaching Scheme	**Examination Scheme**	
Practical: 16 Hrs /Week	ISE III	100 Marks
Credit: 08	End Semester Examination	100 Marks

Course Objectives:

Internship provides an excellent opportunity to learner to see understand the conceptual aspects Learned in classes and deployed into the practical world. Industry/on project experience provides much more professional experience as value addition to classroom teaching.

1. To encourage and provide opportunities for students to get professional/personal experience through internships.
2. To learn and understand real life/industrial situations.
3. To get familiar with various tools and technologies used in industries and their applications.
4. To nurture professional and societal ethics.
5. To create awareness of social, economic and administrative considerations in the working environment of industry organizations.

Course Outcomes:

After completing the course students will able to

Course Outcomes	
CO1	Demonstrate professional competence through industry internship.
CO2	Choose appropriate technology and tools to solve given problem.
CO3	Demonstrate abilities of a responsible professional and use ethical practices in day-to-day life.

Guidelines:

Engineering internships are intended to provide students with an opportunity to apply conceptual knowledge from academics to the realities of the field work/training. The following guidelines are proposed to give academic credit for the internship undergone as a part of the Exit Criteria for second Year B. Tech. (Mechanical Engineering) curriculum.

Duration:

The internship shall have 08 credits, minimum 16 hours per week interaction.

Internship work Identification:

Student may choose to undergo Internship at Industry / Govt. Organizations / NGO / MSME / Rural Internship / Innovation / IPR / Entrepreneurship. Student may choose either to work on innovation or entrepreneurial activities resulting in start-up or undergo internship with industry / NGO's / Government organizations / Micro / Small / Medium enterprises to make themselves ready for the industry.

Student shall take guided internship in a strict supervision of Academic Guide (Preferably Mentor of Teacher Guardian Scheme) and Industrial Supervisor. The internship shall inculcate skills to the incumbent which will facilitate earning livelihood. These skill sets shall be close to vocational education level. Before assigning particular industry/research organization guide shall ensure compatibility of students, availability of internship in the proposed organization expected minimum three skill sets.

Internship work identification process should be initiated before the end of 4^{th} semester in case of Exit criteria of Second Year B. Tech. program in coordination with training and

placement cell / industry institute cell / internship cell. This will help students to start their internship work on time.

Internship Diary/ Internship Workbook:

Students must maintain Internship Diary/ Internship Workbook. The main purpose of maintaining diary/workbook is to cultivate the habit of documenting. The students should record in the daily training diary the day-to-day account of the observations, impressions, information gathered and suggestions given, if any. The training diary/workbook should be signed every day by the supervisor.

Internship Diary/workbook and Internship Report should be submitted by the students along with attendance record and an evaluation sheet duly signed and stamped by the industry to the Institute immediately after the completion of the training.

Internship Work Evaluation: (Assessment)

Every student is required to prepare and maintain documentary proofs of the activities done by him as internship diary or as workbook. The evaluation of these activities will be done by Program Head/Cell In-charge/ Project Head/ faculty mentor or Industry Supervisor based on- Overall compilation of internship activities, sub-activities, the level of achievement expected, evidence needed to assign the points and the duration for certain activities.

Assessment and Evaluation is to be done in consultation with internship supervisor (Internal and External – a supervisor from place of internship). Recommended evaluation parameters- Post Internship Internal Evaluation -100 Marks + Internship Diary/Workbook and Internship Report - 100 Marks.

Feedback from internship supervisor (External and Internal)

Post internship, faculty coordinator should collect feedback about student with recommended parameters include as- Technical knowledge, Discipline, Punctuality, Commitment, Willingness to do the work, Communication skill, individual work, Team work, Leadership…

Mapping of Course outcomes with Program outcomes and Program Specific Outcomes:

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	3	1	1	1					2	1		1		
CO2	2	2	1	1	3				2	1		1	1	
CO3	2	1	1	1		2	1	1	2	1	1	1	1	1

1 – Low, 2 – Medium, 3 – High

Assessment:

ISE III- Continuous Assessment of individual student Maximum Marks-100
ESE – Viva Voce based on presentation and report Maximum Marks-100

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE III	ESE
S1	Implementation	16	16
S2	Manipulation	12	12
S3	Precision	56	56
S4	Articulation	16	16
S5	Naturalization	00	00
Total Marks		100	100

Knowledge Level	ISE III	ESE
Preparation S1	16	16
Articulation of problem S4	16	16
Observation S3	40	40
Record S2	12	12
Mini project/ Presentation/Viva Voce S3	16	16
Total Marks	**100**	**100**

MEVSE2002: CNC Programming		
Teaching Scheme	**Examination Scheme**	
Practical: 8 Hrs. / Week	ISE III	50 Marks
Credits: 4	End Semester Examination	50 Marks

Course Description:

To familiarize the students to apply knowledge of various tools, techniques and coding of CNC machines to manufacture a component of a given dimensions and tolerances. In addition to develop the ability to perform experiments, as well as to analyze and interpret data, also to develop the ability to manufacture the component meet desired needs within realistic constraints.

Course Outcomes:

After completing the course students will able to

Course Outcomes	
CO1	Know the importance of CNC shop safety.
CO2	Understand CNC machine tools, structures, controls, data and system drives and Analyze basics and advancement in NC and CNC for automatic manufacturing.
CO3	Create manual and APT part programs for complex profiles for CNC Lathe and CNC Milling machine, CNC Electrical Discharge Machining and CNC Wire Cut Electrical Discharge Machining.
CO4	Prepare and understand line program for various profiles Identify and set parameters for various simulators.
CO5	Prepare programs, demonstrate, simulate and operate CNC lathe machines, CNC milling machines, CNC EDM & WEDM machines for various machining operations.
CO6	Identify the problems in the functioning of CNC machines and repair them.

List of the Experiments:

Student shall perform minimum eight experiments of the following.

Sr. No	Title of the Experiment	Skill or knowledge level
1	CNC Shop Safety: Safety Awareness, Personal Conduct & Shop Etiquette, Shop Clothing, Proper Shop Attire Illustration, General Safety Practices, CNC Safety Practices.	K2
2	Introduction to CNC machine tools, structures, controls, data and system drives and analyze basics and advancement in NC and CNC for automatic manufacturing.	K2
3	Prepare manual and APT part programs for complex profiles for CNC Lathe and CNC Milling machine, CNC Electrical Discharge Machining and CNC Wire Cut Electrical Discharge Machining	K3
4	Prepare line program for various profiles Identify and set parameters for various simulators	K3
5	Prepare programs, demonstrate, simulate and operate CNC lathe machines for various machining operations.	K5
6	Prepare programs, demonstrate, simulate and operate CNC milling machines for various machining operations.	K5
7	Prepare programs, demonstrate, simulate and operate CNC EDM & WEDM machines for various machining operations.	K5

8	Assembly and dis-assembly of a CNC trainer kit	K5
9	Maintenance of CNC Machines	K5

Mapping of Course outcomes with Program outcomes and Program Specific Outcomes:

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	3	2				2								
CO2	3	2												
CO3	3	2												
CO4	3	2			3									
CO5	3	2	2		3	2						2	2	
CO6	3	2	2		3	2						2	2	

1 – Low, 2 – Medium, 3 – High

Assessment:

ISE-III

The ISE-III will consist of submitting a lab manual for all the experiments with neatly written records of the experiments and diagrams.

The term work will be assessed by the course coordinator.

End Semester Evaluation

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

Assessment Pattern

Assessment Pattern Level No.	Knowledge Level	ISE III	End Semester Examination
K1	Remember	10	10
K2	Understand	10	10
K3	Apply	10	10
K4	Analyze	12	12
K5	Evaluate	8	8
K6	Create		
Total Marks 50		**50**	**50**

MEVSE2003: Skill Development		
Teaching Scheme	**Examination Scheme**	
Practical: 8 Hrs. / Week	ISE III	50 Marks
Credits: 4	End Semester Examination	50 Marks

Course Objectives:

1. To develop the skill required in shop floor working.
2. To have knowledge of the different tools and tackles used in machine assembly shop.
3. Use of theoretical knowledge in practice.
4. Practical aspect of each component in the assembly of the machine.

Course Outcomes:

After completing the course students will able to

Course Outcomes	
CO1	Efficiently and safely perform task on the shop floor
CO2	Acquire comprehensive knowledge of various tools and tackles in machine assembly
CO3	Understand the machine principles to solve the real-world problem
CO4	Proficiency in assembly of engine components

List of Experiments:

1. Tail stock assembly
2. Valve Assembly (PRV, Sluice valve, Steam stop valve)
3. IC engine of Two-Wheeler (4 stroke single cylinder)
4. Hermetically sealed compressor
5. Hydraulic actuator
6. Industrial Gear box
7. Sheet drawing

Note: 1-6 experiments are for assembly and disassembly only

ISE-III

1. Sheet drawing of assembly, which should contain the display of Geometric tolerances, Limits, Fits, BOM, Dimensional measurements techniques. Special Operations. Students should make process sheet of each assembly

End Semester Examination

Practical examination will be based on opening and closing of any assembly. In addition to this some questioning will be asked to the student based on assembly drawing, GD&T. Sequencing and tools and tackles. For this the assemblies and their drawings should be provided to students for examination

Mapping of Course outcomes with Program outcomes and Program Specific Outcomes:

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	1						2		2			2		
CO2					2	2			2					
CO3		2		2					2			2		
CO4	3			1	2				2			2		

1 – Low, 2 – Medium, 3 – High

Assessment:

ISE III- Continuous Assessment of individual student Maximum Marks-50
ESE – Viva Voce based on presentation and report Maximum Marks-50

Assessment Pattern:

Assessment Pattern Level No.	**Knowledge Level**	**ISE III**	**ESE**
S1	Implementation	08	08
S2	Manipulation	06	06
S3	Precision	28	28
S4	Articulation	08	08
S5	Naturalization	00	00
Total Marks		50	25

Knowledge Level	**ISE III**	**ESE**
Preparation S1	08	08
Articulation of problem S4	08	08
Observation S3	18	18
Record S2	06	06
Mini project/ Presentation/Viva Voce S3	10	10
Total Marks	**50**	**50**