Annasaheb Dange College of Engineering and Technology, Ashta

An Autonomous Institute

Curriculum Structure

MECHANICAL ENGINEERING

SEMESTER I - VIII

W.e.f. 2022-23

Department of Mechanical Engineering

Annasaheb Dange College of Engineering and Technology Ashta

Department of Mechanical Engineering

Teaching and Evaluation Scheme

F. Y. B. Tech Semester I																			
Course Code	Course Name	Teaching Scheme				THEORY							PRACTICAL						GRAND TOTAL
						ISE		MSE+ ESE			Total	Min	ISE		ESE		Total	Min	
		L	T	P	Credits	Max	Min	MSE	ESE	Min			Max	Min	Max	Min			
2MEBS101	Applied Chemistry	3	-	-	3	40	16	30	30	24	100	40	-	-	-	-	-	-	100
2MEBS102	Applied Mathematics-I	3	1	-	4	40	16	30	30	24	100	40	-	-	-	-	-	-	100
2MEES103	Engineering Graphics	2	-	-	2	40	16	30	30	24	100	40	-	-	-	-	-	-	100
2MEES104	Basic Electrical & Electronics Engineering	3	-	-	3	40	16	30	30	24	100	40	-	-	-	-	-	-	100
2MEBS105	Applied Chemistry Laboratory	-	-	2	1	-	-	-	-	-	-	-	25	10	-	-	25	10	25
2MEES106	Engineering Graphics with CAD Laboratory	-	-	4	2	-	-	-	-	-	-	-	50	20	-	-	50	20	50
2MEVS107	Computer Programming Laboratory	2	-	2	2	-	-	-	-	-	-	-	50	20	50	20	100	40	100
2MEPC108	Workshop Practice-I	-	-	2	1	-	-	-	-	-	-	-	25	10	-	-	25	10	25
2MEHS109	Value added Course	-	-	2	1	-	-	-	-	-	-	-	50	20	-	-	50	20	50
		13	1	12	19														650
	Total Contact Hours	26																	

Head of Department | Dean Academics | Director | Executive Director

ANNASAHEB DANGE COLLEGE OF ENGINEERING & TECHNOLOGY ASHTA 416 301

Annasaheb Dange College of Engineering and Technology Ashta

Department of Mechanical Engineering

Teaching and Evaluation Scheme

F. Y. B. Tech Semester II

Course Code	Course Name	Teaching Scheme				THEORY							PRACTICAL						GRAND TOTAL
						ISE		MSE+ ESE			Total	Min	ISE		ESE		Total	Min	
		L	T	P	Credits	Max	Min	MSE	ESE	Min			Max	Min	Max	Min			
2MEBS110	Applied Physics	3	-	-	3	40	16	30	30	24	100	40	-	-	-	-	-	-	100
2MEBS111	Applied Mathematics-II	3	1	-	4	40	16	30	30	24	100	40	-	-	-	-	-	-	100
2MEES112	Applied Mechanics	3	1	-	4	40	16	30	30	24	100	40	-	-	-	-	-	-	100
2MEVS113	Computer Programming Using C++	2	-	-	2	40	16	30	30	24	100	40	-	-	-	-	-	-	100
2MEHS114	Professional Communication Skill Laboratory	-	-	4	2	-	-	-	-	-	-	-	50	20	-	-	50	20	50
2MEBS115	Applied Physics Laboratory	-	-	2	1	-	-	-	-	-	-	-	25	10	-	-	25	10	25
2MEVS116	Computer Programming Using C++ Laboratory	-	-	2	1	-	-	-	-	-	-	-	25	10	25	10	50	20	50
2MEPC117	Workshop Practice-II	-	-	2	1	-	-	-	-	-	-	-	25	10	-	-	25	10	25
2MEES118	Design Thinking Laboratory	1	-	2	2	-	-	-	-	-	-	-	50	20	-	-	50	20	50
2MEHS119	Value added Course	-	-	2	1	-	-	-	-	-	-	-	50	20	-	-	50	20	50
		12	**2**	**14**	**21**														**650**
	Total Contact Hours	**28**																	

Head of Department **Dean Academics** **Director** **Executive Director**

ANNASAHEB DANGE COLLEGE OF ENGINEERING & TECHNOLOGY ASHTA
ASHTA 416 301

Annasaheb Dange College of Engineering and Technology Ashta
Department of Mechnical Engineering
Teaching and Evaluation Scheme

ADCET

S. Y. B. Tech Semester III

Course Code	Course Name	Teaching Scheme				THEORY							PRACTICAL						GRAND TOTAL
						ISE		MSE+ ESE			Total	Min	ISE		ESE		Total	Min	
		L	T	P	Credits	Max	Min	MSE	ESE	Min			Max	Min	Max	Min			
2MEPC201	Applied Mathematics-III	3	-	-	3	40	16	30	30	24	100	40	-	-	-	-	-	-	100
2MEPC202	Kinematics of Machines	3	-	-	3	40	16	30	30	24	100	40	-	-	-	-	-	-	100
2MEPC203	Applied Thermodynamics	3	-	-	3	40	16	30	30	24	100	40	-	-	-	-	-	-	100
2MEPC204	Mechanics of Deformable Solids	3	-	-	3	40	16	30	30	24	100	40	-	-	-	-	-	-	100
2MEPC205	Material Science and Metallurgy	2	-	2	3	40	16	30	30	24	100	40	25	10	25	10	50	20	150
2MEPC206	Machine Tools	-	-	2	1	-	-	-	-	-	-	-	25	10	-	-	25	10	25
2MEPC207	Machine Drawing Laboratory	-	-	2	1	-	-	-	-	-	-	-	25	10	25	10	50	20	50
2MEVS208	Python Programming Laboratory	-	-	2	1	-	-	-	-	-	-	-	25	10	-	-	25	10	25
2MEHS209	Universal Human Values	2	-	-	2	50	20	-	-	-	50	20	-	-	-	-	-	-	50
2MEHS210	Environment Studies	2	-	-	2	50	20	-	-	-	50	20	-	-	-	-	-	-	50
2MECC211	Aptitude and Reasoning Part -I	-	-	2	1	-	-	-	-	-	-	-	25	10	-	-	25	10	25
		18	**0**	**10**	**23**														**775**
	Total Contact Hours	**28**																	

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ANNASAHEB DANGE COLLEGE OF ENGINEERING & TECHNOLOGY ASHTA ASHTA 416 301

Annasaheb Dange College of Engineering and Technology Ashta
Department of Mechanical Engineering
Teaching and Evaluation Scheme

S. Y. B. Tech Semester IV

Course Code	Course Name	Teaching Scheme				THEORY							PRACTICAL						GRAND TOTAL
						ISE		MSE+ ESE			Total	Min	ISE		ESE		Total	Min	
		L	T	P	Credits	Max	Min	MSE	ESE	Min			Max	Min	Max	Min			
2ME****	Minor Course-I	2	-	-	2	40	16	30	30	24	100	40	-	-	-	-	-	-	100
2MEPC212	Fluid Mechanics	3	-	2	4	40	16	30	30	24	100	40	25	10	25	10	50	20	150
2MEPC213	Machine Design-I	3	-	-	3	40	16	30	30	24	100	40	-	-	-	-	-	-	100
2MEPC214	Manufacturing Processes	2	-	2	3	40	16	30	30	24	100	40	25	10	-	-	25	10	125
2MEPC215	Dynamics of Machines	2	-	2	3	40	16	30	30	24	100	40	25	10	-	-	25	10	125
2MEPC216	CAD Laboratory	-	-	2	1	-	-	-	-	-	-	-	25	10	25	10	50	20	50
2MEVS217	Microcontroller Laboratory	-	-	2	1	-	-	-	-	-	-	-	25	10	-	-	25	10	25
2MEEL218	Innovation/Prototype	-	-	2	1	-	-	-	-	-	-	-	25	10	-	-	25	10	25
2MEHS219	Psychology	2	-	-	2	50	20	-	-	-	50	20	-	-	-	-	-	-	50
2MEHS220	Constitution of India	1	-	-	1	25	10	-	-	-	25	10	-	-	-	-	-	-	25
2MECC221	Aptitude and Reasoning Part -II	-	-	2	1	-	-	-	-	-	-	-	25	10	-	-	25	10	25
		15	**0**	**14**	**22**														**800**
	Total Contact Hours	**29**																	

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ANNASAHEB DANGE COLLEGE OF ENGINEERING & TECHNOLOGY ASHTA
ASHTA 416 301

Annasaheb Dange College of Engineering and Technology Ashta

Department of Mechanical Engineering

Teaching and Evaluation Scheme

T. Y. B. Tech Semester V																		
Course Code	Course Name	Teaching Scheme				THEORY							PRACTICAL					GRAND TOTAL
						ISE		MSE+ ESE			Total	Min	ISE	ESE		Total	Min	
		L	T	P	Credits	Max	Min	MSE	ESE	Min				Max	Min			
2MEPC301	Machine Design-II	2	-	2	3	40	16	30	30	24	100	40	25	-	-	25	10	125
2MEPC302	Turbo Machinery	2	-	2	3	40	16	30	30	24	100	40	25	25	10	50	20	150
2MEPC303	Measurement and Metrology	2	-	2	3	40	16	30	30	24	100	40	25	25	10	50	20	150
2MEEL304	In-plant Training/Internship	-	-	-	1	-	-	-	-	-	-	-	25	-	-	25	10	25
2MEHS305	Entrepreneurship	-	-	2	1	-	-	-	-	-	-	-	50	-	-	50	20	50
2MECC306	Aptitude and Reasoning Part -III	-	-	2	1	-	-	-	-	-	-	-	50	-	-	50	20	50
2MEPE3**	Professional Elective-I	3	-	2	4	40	16	30	30	24	100	40	25	-	-	25	10	125
2ME*****	Minor Course - II	3	-	-	3	40	16	30	30	24	100	40	-	-	-	-	-	100
2ILOE3**	Open Elective - I	3	-	-	3	50	20	-	-	-	50	20	-	-	-	-	-	50
		15	0	12	12													825
	Total Contact Hours	27																

Head of Department

Dean Academics

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ASHTA 416 301

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Professional Elective - I		
Course Code	**Course Name**	**Domain**
2MEPE307	Noise and Vibration	Design
2MEPE308	Machine Tool Design	
2MEPE309	Experimental Stress Analysis	
2MEPE310	I. C. Engines	Thermal
2MEPE311	Steam Engineering	
2MEPE312	Renewable Energy Engineering	
2MEPE313	Foundry and Forming Technology	Manufacturing
2MEPE314	Industrial Management and Operation Research	
2MEPE315	Industrial Engineering	

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ANNASAHEB DANGE COLLEGE OF ENGINEERING & TECHNOLOGY ASHTA 416 301

Annasaheb Dange College of Engineering and Technology Ashta
Department of Mechanical Engineering
Teaching and Evaluation Scheme

T. Y. B. Tech Semester VI

Course Code	Course Name	Teaching Scheme				THEORY							PRACTICAL					GRAND TOTAL
						ISE		MSE+ ESE			Total	Min	ISE	ESE		Total	Min	
		L	T	P	Credits	Max	Min	MSE	ESE	Min				Max	Min			
2MEPC316	Tool Engineering	3	-	2	4	40	16	30	30	24	100	40	25	-	-	25	10	125
2MEPC317	Heat and Mass Transfer	3	-	2	4	40	16	30	30	24	100	40	25	25	10	50	20	150
2MEVS318	Control Engineering Laboratory	-	-	2	1	-	-	-	-	-	-	-	25	25	10	50	20	50
2MEPC319	Computer Aided Manufacturing(CAM) Laboratory	-	-	2	1	-	-	-	-	-	-	-	25	-	-	25	10	25
2MEEL320	Mini Project	-	-	2	2	-	-	-	-	-	-	-	50	-	-	50	20	50
2MECC321	Aptitude and Reasoning Part -IV	-	-	2	1	-	-	-	-	-	-	-	50	-	-	50	20	50
2MEPE3**	Professional Elective- II	3	-	2	4	40	16	30	30	24	100	40	25	-	-	25	10	125
2ME*****	Minor Course - III	3	-	-	3	40	16	30	30	24	100	40	-	-	-	-	-	100
2ILOE3**	Open Elective - II	3	-	-	3	50	20	-	-	-	50	20	-	-	-	-	-	50
		15	0	14	13													725
	Total Contact Hours	29																

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ANNASAHEB DANGE COLLEGE OF ENGINEERING & TECHNOLOGY ASHTA
ASHTA 416 301

Professional Elective - II		
Course Code	**Course Name**	**Domain**
2MEPE322	Finite Element Analysis	Design
2MEPE323	Mechanical System Design	
2MEPE324	Condition Monitoring	
2MEPE325	Solar Technology	Thermal
2MEPE326	Computational Fluid Dynamics	
2MEPE327	Alternative Fuels	
2MEPE328	Non Destructive Techniques	Manufacturing
2MEPE329	Modern Manufacturing Processes	
2MEPE330	Metal Joining Process	

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ANNASAHEB DANGE COLLEGE OF ENGINEERING & TECHNOLOGY ASHTA 416 301

Open Elective Courses		
Course Code	**Course Category**	**Course Name**
21I.OE351	Health Care Management	Economics of Health and Education
21I.OE352	Business Marketing	Business to Business Marketing (B2B)
21I.OE353	Intellectual Property Rights	Patent Law for Engineers and Scientists
21I.OE354		Economics of Innovation
21I.OE355	Business Laws	E-Business
21I.OE356	Finance and Accounting	Management Accounting
21I.OE357	Banking and Insurance	Economics of Banking and Finance Markets
21I.OE358	Investment Management	Quantitative Investment Management
21I.OE359	Human Resource Management	Human Resource Development
21I.OE360	Business Management	Advanced Business Decision Support Systems
21I.OE361	Language	Introduction to Japanese Language and Culture - II
21I.OE362		German - I
21I.OE363	Retail and Channel Management	Operations and Supply Chain Management

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ANNASAHEB DANGE COLLEGE OF ENGINEERING & TECHNOLOGY ASHTA 416 301

Annasaheb Dange College of Engineering and Technology Ashta
Department of Mechanical Engineering

ADCET

Teaching and Evaluation Scheme

Final Year B. Tech Semester VII

Course Code	Course Name	Teaching Scheme				THEORY							PRACTICAL						GRAND TOTAL
						ISE		MSE+ ESE			Total	Min	ISE		ESE		Total	Min	
		L	T	P	Credits	Max	Min	MSE	ESE	Min			Max	Min	Max	Min			
2MEOE4**	Open Elective - III	2	-	-	2	50	20	-	-	-	50	20	-	-	-	-	-	-	50
2ME*****	Minor Course - IV	3	-	-	3	40	16	30	30	24	100	40	-	-	-	-	-	-	100
2MEPC401	Refrigeration and Air Conditioning	3	-	2	4	40	16	30	30	24	100	40	25	10	25	10	50	20	150
2MEPC402	Industrial Fluid Power and Automation	3	-	2	4	40	16	30	30	24	100	40	25	10	-	-	25	10	125
2MEPC403	Mechatronics and Robotics	3	-	2	4	40	16	30	30	24	100	40	25	10	25	10	50	20	150
2MEHS404	Project Management and Finance	2	-	-	2	40	16	30	30	24	100	40	-	-	-	-	-	-	100
2MEEL405	Project	-	-	8	4	-	-	-	-	-	-	-	50	20	75	30	125	50	125
		16	0	14	23														800
	Total Contact Hours	30																	

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ANNASAHEB DANGE COLLEGE OF ENGINEERING & TECHNOLOGY ASHTA
ASHTA 416 301

Annasaheb Dange College of Engineering and Technology Ashta

Department of Mechanical Engineering

Teaching and Evaluation Scheme

Final Year B. Tech Semester VIII

Course Code	Course Name	Teaching Scheme				THEORY							PRACTICAL						GRAND TOTAL
						ISE		MSE+ ESE			Total	Min	ISE		ESE		Total	Min	
		L	T	P	Credits	Max	Min	MSE	ESE	Min			Max	Min	Max	Min			
2MEPE4**	Professional Elective- III	3	1	-	4	40	16	30	30	24	100	40	-	-	-	-	-	-	100
2ME*****	Minor Project	-	-	-	3	-	-	-	-	-	-	-	100	40	-	-	100	40	100
2MEEL407	Internship	-	-	-	10	-	-	-	-	-	-	-	200	80	-	-	200	80	200
		3	1	0	17														400
	Total Contact Hours	4																	

Head of Department

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ANNASAHEB DANGE COLLEGE OF ENGINEERING & TECHNOLOGY ASHTA
ASHTA 416 301

Professional Elective - III		
Course Code	**Course Name**	**Domain**
2MEPE408	Reliability Engineering	Design
2MEPE409	Vehicle Engineering	
2MEPE410	Process Equipment Design	
2MEPE411	Power Plant Engineering	Thermal
2MEPE412	Energy Management	
2MEPE413	Design of Thermal Systems	
2MEPE414	Cogeneration and Waste Heat Management	
2MEPE415	IMOR	Manufacturing
2MEPE416	Industrial Engineering	
2MEPE417	Total Quality Management	
2MEPE418	Total Productive Maintenance	
2MEPE419	Production Management	
2MEPE420	Supply Chain Management	

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ANNASAHEB DANGE COLLEGE OF ENGINEERING & TECHNOLOGY ASHTA 416 301

Annasaheb Dange College of Engineering and Technology Ashta

Department of Mechanical Engineering

B. Tech Program with One Major and One Minor (170 Credits)

Course Category	I	II	III	IV	V	VI	VII	VIII	Total
Basic Sciences	8	8							16
Engineering Science	7	6							13
Program Core	1	1	17	14	9	9	12		63
Program Elective					4	4		4	12
Minor				2	3	3	3	3	14
Open Elective					3	3	2		8
Vocational and Skill Enhancement Courses	2	3	1	1		1			8
Humanities and Social Sciences	1	3	4	3	1		2		14
Experential Learning Courses				1	1	2	4	10	18
Co-curricular Courses			1	1	1	1			4
Total	**19**	**21**	**23**	**22**	**22**	**23**	**23**	**17**	**170**

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ANNASAHEB DANGE COLLEGE OF ENGINEERING & TECHNOLOGY ASHTA ASHTA 416 301

DEPARTMENT OF MECHANICAL ENGINEERING

(Courses for Multiple Entry-Multiple Exits, Multidisciplinary and Specialized Minors, Honors and Research)

According to this curricular framework of the B. Tech Curriculum Structure in accordance with NEP2020, a complete set of courses for different learners to opt for : 1-Year UG Certificate, 2 Year UG Diploma in respective Major Programme and 3 Year B.Sc degree.

A. Courses for Minors

Totally 170 credits required to earn an undergraduate engineering degree which includes **Multidisciplinary Minor in Mechanical Engineering of 14 Credits.**

Course Code	Course Name	L	T	P	Credits
2MEIE201	Industrial Engineering	2			2
2MEIE301	Operations Research	3			3
2MEIE302	Supply Chain Management	3			3
2MEIE401	Total Quality Management	3			3
2MEIE451	Minor Project			3	3
Total		11		3	14

OR

Course Code	Course Name	L	T	P	Credits
2MEBM201	Engineering Materials	2			2
2MEBM301	Manufacturing Process	3			3
2MEBM302	Machines and Mechanisms	3			3
2MEBM401	Reliability Engineering	3			3
2MEBM451	Minor Project			3	3
Total		11		3	14

B. Courses for Double Minor (Specialization Minor)

An additional 14 credits required to earn under **Double Minor (Specialization Minor, Mechanical)** to get eligible for **Under Graduate** engineering **degree with Double Minor** .

Course Option	Credits	Platform
Geometrical Tolerances and Dimensions	2	--
Unigraphics/Creo/Solidworks Certification	3	Certification
ANSYS Multiphysics/ Hypermesh	3	Certification
FLUENT/Piping Design	3	Certification
Project	3	--
Total	14	

C. Courses for Honours

An additional 18 credits required to earn under **Honors in Mechanical Engineering with Robotics** to get eligible for **Under Graduate Engineering degree with Honors and Multidisciplinary Minor** .

Course Name	Credits	Platform
Mechanics of Robots	3	NPTEL/Online Course
Microprocessor & Embedded Systems	3	NPTEL/Online Course
Python and Arduino programming(Robot Programming)	3	NPTEL/Online Course
Control of Robotic Systems	3	NPTEL/Online Course
Project	6	NPTEL/Online Course
Total	18	

D. Courses for Honors with Research

An additional 18 credits required to earn under **Honors with Research** to get eligible for **Under Graduate Engineering degree with Honors with Research and Multidisciplinary Minor .**

Course Name	Credits	Platform
Research Methodology	4	NPTEL/Online Course
Dissertation in Sem VII and Sem VIII	14	
Total	**18**	

E. Compulsory Courses for Multiple Entry-Multiple Exits

First Year	➢ Computer Aided Drafting ➢ Welding and Fabrication ➢ Pattern making ➢ Fitter ➢ Assembly Technician ➢ Turner
Second Year	➢ CNC Programming ➢ 3D Modeling Software (CATIA, SolidWORKS, Creo, NX) ➢ Application of Ardino Programming ➢ Vehicle Maintenance ➢ Machinist ➢ Automotive Service Techniques
Third Year	➢ HVAC ➢ Training on ANSYS/Hypermech ➢ Industrial Hydraulics and Pneumatics ➢ Automation and Robotics ➢ Piping Design ➢ Bearing Maintenance

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ANNASAHEB DAMGE COLLEGE OF ENGINEERING & TECHNOLOGY ASHTA 416 301

Annasaheb Dange College of Engineering and Technology, Ashta

An Autonomous Institute

F.Y. B. Tech. Curriculum

MECHANICAL ENGINEERING

SEMESTER I - II

W.e.f. 2022-23

Department of Mechanical Engineering

Teaching and Evaluation Scheme
F. Y. B. Tech Semester I

Course Code	Course Name	Teaching Scheme				THEORY							PRACTICAL						GRAND TOTAL
						ISE		MSE+ ESE			Total	Min	ISE		ESE		Total	Min	
		L	T	P	Credits	Max	Min	MSE	ESE	Min			Max	Min	Max	Min			
2MEBS101	Applied Chemistry	3	-	-	3	40	16	30	30	24	100	40	-	-	-	-	-	-	100
2MEBS102	Applied Mathematics-I	3	1	-	4	40	16	30	30	24	100	40	-	-	-	-	-	-	100
2MEES103	Engineering Graphics	2	-	-	2	40	16	30	30	24	100	40	-	-	-	-	-	-	100
2MEES104	Basic Electrical & Electronics Engineering	3	-	-	3	40	16	30	30	24	100	40	-	-	-	-	-	-	100
2MEBS105	Applied Chemistry Laboratory	-	-	2	1	-	-	-	-	-	-	-	25	10	-	-	25	10	25
2MEES106	Engineering Graphics with CAD Laboratory	-	-	4	2	-	-	-	-	-	-	-	50	20	-	-	50	20	50
2MEVS107	Computer Programming Laboratory	2	-	2	2	-	-	-	-	-	-	-	50	20	50	20	100	40	100
2MEPC108	Workshop Practice-I	-	-	2	1	-	-	-	-	-	-	-	25	10	-	-	25	10	25
2MEHS109	Value added Course	-	-	2	1	-	-	-	-	-	-	-	50	20	-	-	50	20	50
		13	1	12	19														650
	Total Contact Hours	26																	

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Course Details:

Class	F.Y. B.Tech: Semester-I
Course Code and Course Title	**2MEBS101, Applied Chemistry**
Prerequisite/s	---
Teaching Scheme: Lecture/Tutorial/Practical	03/00/00
Credits	03
Evaluation Scheme: ISE/MSE/ESE	40/30/30

Course Outcomes: Upon successful completion of this course, the students will be able to:	
2MEBS101_1	**Apply** principles of water testing to identify water quality parameters and methods of water softening using fundamental laws.
2MEBS101_2	**Classify** fuels and analytical methods to identify their characteristics using basic principles of chemistry.
2MEBS101_3	**Select** engineering, ceramic materials on the basis of its properties and applications using their chemical composition.
2MEBS101_4	**Apply** the methods of prevention of corrosion to a given metal considering it's types and factors affecting corrosion.
2MEBS101_5	**Compute** the values of hardness of water and calorific values of fuels using fundamental equations.

Course Contents:		**Hrs.**
Unit 1	**Water Technology:** Introduction, impurities in natural water, Water Testing: acidity, alkalinity and chlorides, hardness of water (definition, causes and significance), Calculations of total hardness, disadvantages of hard water in domestic and industrial applications. Scales and sludges: Formation in boilers and removal, Treatment of hard water by ion- exchange process, Zeolite process, Desalination of brackish water by Reverse Osmosis.	**07**
Unit 2	**Chemical and Instrumental Techniques:** Chemical analysis, its types, Different ways to express concentration of solution. Numerical problems. Standards and its types. **p^H-metry:** Introduction, pH measurement using glass electrode and applications. **Spectrometry**: Introduction, Laws of spectrometry (Lamberts and Beer-Lambert's law). Instrumentation and applications of UV-Visible spectrophotometer, **Chromatography**: Introduction, Principle, instrumentation and applications of gas-liquid chromatography (GLC).	**07**
Unit 3	**Engineering Materials:** **A) Polymers**: Introduction, plastics, thermo-softening and thermosetting plastics, industrially important plastics like phenol-formaldehyde, urea formaldehyde. Conducting polymers, biodegradable polymers (properties and applications), composites, FRP and glass reinforced plastics (GRP). **B) Lubricants:** Introduction, classification of lubricants (solid, semisolid and liquid), lubrication and it's types, characteristics of lubricants: viscosity, viscosity index, flash point, fire point, cloud point and pour point.	**07**

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Unit 4	**Fuels and Non-conventional Energy Sources:** **Fuels:** Introduction, classification, characteristics of good fuels, comparison between solid, liquid and gaseous fuels, types of calorific value (higher and lower), Bomb calorimeter and Boy's calorimeter. Numericals on Bomb and Boy's calorimeter. **Batteries:** Introduction, Characteristics of a battery, Rechargeable Li- ion batteries (Diagram, charging-discharging reactions, advantages and applications). **Fuel Cells:** Introduction, H_2-O_2 Fuel cell (Construction, working and applications), applications of fuel cells.	**07**
Unit 5	**Corrosion& Green Chemistry:** **Corrosion:** Introduction, causes, types, Atmospheric corrosion (oxidation corrosion), Electrochemical corrosion (hydrogen evolution and oxygen absorption mechanism), factors affecting rate of corrosion. Prevention of corrosion by proper design and material selection, hot dipping (galvanizing and tinning), cathodic protection method, electroplating, metal cladding. **Green Chemistry:** Definition, Twelve principles of green chemistry, Research and industrial applications.	**07**
Unit 6	**Metallic & Ceramic Materials:** **Alloys:** Introduction, alloy definition and classification, purposes of making alloys. Ferrous alloys: Plain carbon steels (mild, medium and high). Nonferrous alloys: Copper alloy (Brass), Nickel alloy (Nichrome), Aluminum alloy (Duralumin and Alnico). **Ceramic Materials:** Introduction, types of ceramics, types of cement & their applications, Manufacture of Portland Cement by wet process, Composition of Portland Cement & their functions- a) Chemical composition, b) Compound composition, Setting & hardening of Portland Cement.	**07**

Text Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
01	A Text Book of Engineering Chemistry	S. S. Dara	S. Chand & Co. Ltd., New Delhi.	11th	2008
02	A Text book of Engineering Chemistry	ShashiChawala	DhanpatRai Publishing Co. New Delhi.	3rd	2007
03	A Test Book of Applied Chemistry	Ziyauddin D. Sande, Vijayalaxmi M. Vairat, Pratapsingh V. Gaikwad	Wiley Publications	1st	2018
04	A Textbook for Engineers and Technologists	Oleg Roussak, H. D. Gesser	Kindle Edition, Springer	2nd	2021

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Reference Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Engineering Chemistry	Jain & Jain	DhanpatRai Publishing Co., New Delhi.	16th	2015
02	Industrial Chemistry	B. K. Sharma	Goel publication (P) Ltd.	10th	1999
03	Fundamentals of Engineering Chemistry	S. K. Singh	New Age International (P) Ltd, New Delhi.	1st	2009
04	Instrumental Methods of Chemical Analysis	Chatwal and Anand	Himalaya Publishing House, Mumbai.	5th	2005
05	Engineering Chemistry	Wiley India	Wiley India Pvt. Ltd., New Delhi.	1st	2012

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Course Details:

Class	F.Y. B.Tech: Semester-I
Course Code and Course Title	**2MEBS102, Applied Mathematics I**
Prerequisite/s	--
Teaching Scheme: Lecture/Tutorial/Practical	03/01/00
Credits	04
Evaluation Scheme: ISE/MSE/ESE	40/30/30

Course Outcomes: Upon successful completion of this course, the student will be able to:	
2MEBS102 _1	**Solve** the system of linear equations by using matrix method.
2MEBS102 _2	**Calculate** Eigen values and Eigen vectors.
2MEBS102 _3	**Compute** various measures of central tendencies, dispersion and to interpret them.
2MEBS102 _4	**Fit** the curves for bivariate data by applying least square techniques.
2MEBS102 _5	**Apply** Taylor series to find the expansion of functions.
2MEBS102 _6	**Compute** the n^{th} power and roots of the complex number by using De-Moivre's Theorem.

Course Contents:		**Hrs.**
Unit 1	**Matrices and Solution of Linear System Equations:** Rank of a matrix, Normal form of a matrix, echelon form, Consistency of linear system of equations (system of homogeneous and non- homogeneous linear equation).	**07**
Unit 2	**Eigen Values and Eigen Vectors:** Vectors, Linear dependence and linear independence of vectors, Eigen values, Properties of Eigen values, Eigen vectors, Properties of Eigenvectors.	**06**
Unit 3	**Measures of Central Tendency and Dispersion:** Arithmetic Mean, Geometric Mean, Harmonic Mean, Median, Mode, Partition values: Quartiles, Deciles and Percentiles, Standard Deviation and Variance.	**07**
Unit 4	**Curve fitting and Statistics:** Method of Least Squares, Fitting of Straight Line, Fitting of Parabola, Fitting of exponential curves, Lines of Regression.	**07**
Unit 5	**Expansion of Functions and Indeterminate Forms:** Taylor's series, Maclaurin's series, Standard expansions, Expansion of function using Standard series, Indeterminate forms.	**07**
Unit 6	**Complex Numbers:** De Moivre's theorem, Roots of a complex number, Expansion of sin(nx) and cos(nx) in powers of sinx and/or cosx, Circular functions of a complex variable, Hyperbolic functions, relation between circular and hyperbolic functions, Inverse Hyperbolic functions.	**08**

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Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	A Text Book of Engineering Mathematics	N. P. Bali, Manish Goyal	Laxmi Publications(P) Ltd	8th	2011
02	Advanced Engineering Mathematics	H. K. Das	S. Chand	22nd	2018
03	Higher Engineering Mathematics	B. V. Ramana	Tata McGraw Hill Publ.	6th	2010
04	Probability and Statistics for Engineers	PHI Learning private limited	Richard A. Johnson	8th	2014

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Higher Engineering Mathematics	Dr. B. S. Grewal	Khanna Publishers	44th	2018
02	Advanced Engineering Mathematics	N. P. Bali, Manish Goyal	Infinity science press	7th	2010
03	Advanced Engineering Mathematics	Erwin Kreyszig	Wiley Publishers	10th	2017
04	Probability and Statistics for Engineers	Dr. J. Ravichandran	Wiley	1st	2012

List of Tutorials:

Sr. No.	Title of Tutorials
01	Matrices and Solution of Linear System Equations
02	Matrices and Solution of Linear System Equations
03	Eigen Values and Eigen Vectors.
04	Measures of Central Tendency and Dispersion
05	Measures of Central Tendency and Dispersion
06	Curve fitting and Statistics
07	Curve fitting and Statistics
08	Expansion of Functions and Indeterminate Forms

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Course Details:

Class	F.Y. B.Tech: Semester-I
Course Code and Course Title	**2MEES103, Engineering Graphics**
Prerequisite/s	--
Teaching Scheme: Lecture/Tutorial/Practical	02/00/00
Credits	02
Evaluation Scheme: ISE/MSE/ESE	40/30/30

Course Outcomes: After successful completion of this course, the student will be able to:	
2MEES103_1	**Sketch** projection of simple geometries [point, line, planes].
2MEES103_2	**Sketch** projection of solids inclined to reference plane
2MEES103_3	**Produce** the orthographic projection.
2MEES103_4	**Produce** the isometric projection.
2MEES103_5	**Prepare** sectional view of solids.

Course Contents:		**Hrs.**
Unit 1	**Fundamentals of Engineering Graphics and Engineering Curves** **A) Fundamentals of Engineering Graphics:** Introduction to Drawing instruments and their uses. Different types of lines used in drawing practice, Dimensioning system as per BSI (Theoretical treatment only) **B) Engineering curves:** Construction of regular Polygons up to hexagon). Ellipse, Parabola, Hyperbola, Involute, Archimedean spiral, Cycloid.	**04**
Unit 2	**Projection of lines:** Introduction to First angle and third angle methods of projection. Projections of points on regular and auxiliary reference planes. Projections of lines (horizontal, frontal, oblique and Profile lines) on regular and auxiliary reference planes. The true length of a line, Point View of a line, angles made by the line with reference planes. Projections of intersecting lines, Parallel lines, perpendicular lines, and skew lines. grade and bearing of a line.	**04**
Unit 3	**Projection of plane:** Projections on regular and on auxiliary reference planes. Types of planes (horizontal, frontal, oblique and Profile planes), Edge view and True shape of a Plane. Angles made by the plane with Principle reference planes. Projection of plane figure inclined to both the plane. (Circle and regular polygon).	**04**
Unit 4	**Projection of solid:** Projection of solids such as Prisms, Pyramids, Cylinder and Cones inclined to both reference plane (excluding frustum and sphere).	**06**
Unit 5	**Sections of solids:** Prisms, Pyramids, Cylinders and Cones, in simple positions and inclined to one reference plane and parallel to others.	**04**
Unit 6	**Development of plane and curved surfaces:** Prisms, Pyramids, Cylinders and Cones along with cutting planes.	**04**

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Text Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Engineering Drawing & Graphics	K. Venugopal	New Age Publication	5th	2012
02	Engineering Drawing	M. B. Shaha and B. C. Rana	Pearson Education	2nd	2012
03	ABC's of Auto CAD	George Omura	BPB Publication.	--	--
04	Engineering graphic with Auto CAD 2002,	Bethune	Pearson Publication	--	--

Reference Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Engineering Drawing	N D Batt & V M Panchal	Charotor Publication House, Bombay	50th	2010
02	Engineering Drawing	Dhananjay A Jhole	Tata Mc-Graw Hill	5th	2011
03	Fundamentals of Engineering Drawing	Warren. J. Luzadder	Prentice-Hall of India.	11th	1999
04	Engineering Drawing	P S Gill	Katson books	9th	2012

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Course Details:

Class	F.Y. B.Tech: Semester-I
Course Code and Course Title	**2MEES104, Basic Electrical & Electronics Engineering**
Prerequisite/s	Simultaneous Linear Equations & Semiconductor Physics
Teaching Scheme: Lecture/Tutorial/Practical	03/00/00
Credits	03
Evaluation Scheme: ISE/MSE/ESE	40/30/30

Course Outcomes: Upon successful completion of this course, the student will be able to:	
2MEES104 _1	**Solve** the DC circuits with independent sources using Kirchhoff's laws and Network Theorems.
2MEES104 _2	**Analyze** A. C. circuits with an interpretation of the relationship between voltage, current, and power.
2MEES104 _3	**Explain** the construction and working principle of electrical machines, and their applications.
2MEES104 _4	**Discuss** the working principles and characteristics of semiconductor devices
2MEES104 _5	**Construct** sequential logic circuits and combinational logic circuits.
2MEES104 _6	**Explain** the transducer to measure the physical quantities and their applications

Course Contents:		**Hrs.**
Unit 1	**DC Circuits:** Electrical circuit elements, KCL and KVL. Star- delta conversion, voltage, and current sources. Thevenin, Norton, and Superposition.	**07**
Unit 2	**AC Circuits:** Sinusoidal waveforms, peak, average, RMS values, phasor representation, real, reactive, and apparent power. Analysis of single-phase, AC circuits consisting of R, L, C, RL, RC, RLC circuits, and three-phase balanced circuits. Voltage and current relations in star and delta.	**07**
Unit 3	**Electrical Machines:** Construction, Principle of Operation, Basic Equations and Applications of DC Generators, DC Motors, Single-Phase Transformer, and Single-Phase Induction Motor. Applications of Stepper, Servo, and Universal Motors. Introduction to Fuse & Circuit breakers	**07**
Unit 4	**Semiconductor Devices and Applications**: Introduction - Characteristics of PN Junction Diode, Zener Effect – Zener Diode and its Characteristics – Half Wave and Full Wave Rectifiers – Bipolar Junction Transistor – CB, CE, CC Configurations and Characteristics	**07**
Unit 5	**Digital Electronics:** Binary Number System – Boolean Algebra theorems– Digital circuits - Introduction to sequential Circuits– Flip-Flops – Registers and Counters – A/D and D/A Conversion	**07**
Unit 6	**Transducers & Applications:** Transducers for Displacement, level, temperature pressure speed measurement range specifications, Applications of transducers in Digital thermometer, weighing machine, washing machine, microwave oven, and mobile handset.	**07**

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Text Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Principles of Electrical Engineering and Electronics	V. K. Mehta	S. Chand & Co., Publications, New Delhi	3rd	2010
02	Basic Electrical and Electronics Engineering	D.P. Kothari	TMH, New Delhi	2nd	2014
03	Electrical Circuit Theory and Technology	John Bird	Routledge	5th	2013
04	Sensors and Transducers	D. Patranabi	PHI Learning Pvt. Ltd	2nd	2003

Reference Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Integrated Electronics	Millman and Halkias	McGraw Hill	2nd	2010
02	Electrical Technology", Vol.–II	A.K. Thereja and B.L.Thereja,	S. Chand & Co., Publications	2nd	2007
03	Basic Electrical Engineering	U. Bakshi and A. Bakshi	Technical Publications, Pune	1st	2005
04	Electronic Principles	Albert Malvino, David Bates	McGraw Hill Education	7th	2017

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Course Details:

Class	F.Y. B.Tech: Semester-I
Course Code and Course Title	**2MEBS105, Applied Chemistry Laboratory**
Prerequisite/s	--
Teaching Scheme: Lecture/Tutorial/Practical	00/00/02
Credits	01
Evaluation Scheme: ISE/ESE	25/00

Course Outcomes: Upon successful completion of this course, the students will be able to:	
2MEBS105_1	**Determine** the hardness acidity, alkalinity, chloride content using appropriate methods of titration for given sample of water.
2MEBS105_2	**Estimate** rate of corrosion in acidic and alkaline medium by depreciation of weight.
2MEBS105_3	**Use** pH meter to determine pH value of given solution and validate the findings with suitable optical method (photo-colorimeter) and graphical methods.
2MEBS105_4	**Analyze** coal sample, lubricants and aqueous solutions to get the percentage compositions using appropriate methods.
2MEBS105_5	**Communicate** effectively about laboratory work both orally and writing.

List of Experiments:

Expt. No.	Title of the Experiment
01	Determination of acidity of water sample. (Neutralization Titration)
02	Determination of alkalinity of water sample. (Acid- Base Titration).
03	Determination of chloride content of water by Mohr's method. (Precipitation Titration).
04	Determination of total hardness of water sample by EDTA method.
05	Determination of moisture, voltile and ash content in a given coal sample. (Proximate analysis)
06	Preparation of Urea-formaldehyde resin.
07	Determination of viscosity of lubricating oil.
08	Estimation of zinc in brass solution (Displacement Titration)
09	Estimation of copper in brass solution (Displacement Titration)
10	Determination of rate of corrosion of aluminum in acidic and basic medium
11	Determination of pH of sample solution by pH meter
12	Determination of calorific value of fuel using Bomb calorimeter.
13	Demonstration of Photo-colorimeter.

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Text Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	A Text Book of Engineering Chemistry	S. S. Dara	S. Chand & Co. Ltd., New Delhi.	11th	2008
02	A Text book of Engineering Chemistry	ShashiChawala	DhanpatRai Publishing Co. New Delhi.	3rd	2007
03	A Test Book of Applied Chemistry	Ziyauddin D. Sande, Vijayalaxmi M. Vairat, Pratapsingh V. Gaikwad	Wiley Publications	1st	2018
04	A Textbook for Engineers and Technologists	Oleg Roussak, H. D. Gesser	Kindle Edition, Springer	2nd	2021

Reference Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Engineering Chemistry	Jain & Jain	DhanpatRai Publishing Co., New Delhi.	16th	2015
02	Industrial Chemistry	B. K. Sharma	Goel publication (P) Ltd.	10th	1999
03	Fundamentals of Engineering Chemistry	S. K. Singh	New Age International (P) Ltd, New Delhi.	1st	2009
04	Instrumental Methods of Chemical Analysis	Chatwal and Anand	Himalaya Publishing House, Mumbai.	5th	2005
05	Engineering Chemistry	Wiley India	Wiley India Pvt. Ltd., New Delhi.	1st	2012

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Course Details:

Class	F.Y. B.Tech: Semester-I
Course Code and Course Title	**2MEES106, Engineering Graphics with CAD Laboratory**
Prerequisite/s	--
Teaching Scheme: Lecture/Tutorial/Practical	00/00/04
Credits	02
Evaluation Scheme: ISE/ESE	50/00

Course Outcomes: After successful completion of this course, the student will be able to:	
2MEES106_1	**Prepare** drawing of Points, lines, Planes using Auto Cad.
2MEES106_2	**Plot** projection of solids.
2MEES106_3	**Produce** the orthographic projection.
2MEES106_4	**Plot** the isometric projection.
2MEES106_5	**Prepare** sectional view of solids.

Course Contents: Theory

1. Basic command to draw 2- D objects like line, point, circle, arc, ellipse, polygon, Polyline, spline etc.
2. Editing: Erase, extension, breaking, fillet, chamfer, trimming, scaling etc.
3. Viewing and other: Zoom pan, mirroring, rotating, moving objects, arrange blocks, Offset etc.
4. Hatching of sections.
5. Use of layers in drawing
6. Plotting of drawing

Course Contents: Laboratory

Sr. No.	Title
01	Computer aided drafting of Line, circle and polygon (upto Hexagon only).
02	Computer aided drafting of orthographic vies of simple 3d objects.
03	Computer aided drafting of Isometric view.
04	Plotting of sectional views of given solids or small 3D machine components.

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Text Books:					
Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Engineering Drawing	N D Batt & V M Panchal	Charotor Publication House, Bombay	50th	2010
02	Engineering Drawing	Dhananjay A Jhole	Tata Mc-Graw Hill	5th	2011
03	Engineering Drawing	P S Gill	Katson books	9th	2012
04	ABC's of Auto CAD	George Omura	BPB Publication.		
05	Engineering graphic with Auto CAD 2002,	Bethune	Pearson Publication		

Reference Books:					
Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Engineering Drawing & Graphics	K. Venugopal	New Age Publication	5th	2012
02	Engineering Drawing	M. B. Shaha and B. C. Rana	Pearson Education	2nd	2012

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Course Details:

Class	F.Y. B.Tech: Semester-I
Course Code and Course Title	**2MEVS107, Computer Programming Laboratory**
Prerequisite/s	--
Teaching Scheme: Lecture/Tutorial/Practical	02/00/02
Credits	02
Evaluation Scheme: ISE /ESE	50/50

Course Outcomes: Upon successful completion of this course, the student will be able to:	
2MEVS107_1	**Write,** compile and debug programs in C language.
2MEVS107_2	**Make** use of different data types and operators to solve various civil Engineering problems.
2MEVS107_3	**Make** use of conditional expressions and looping statements to solve civil Engineering problems associated with conditions and repetitions.
2MEVS107_4	**Demonstrate** C Programs for various problem statements.
2MEVS107_5	**Practice** C program for various Mechanical Engineering problem statements.

Course Contents: Theory		**Hrs.**
Unit 1	**Computer Fundamentals with Basics of Programming** Introduction to Computer, Computer System Hardware, Input and Output Devices, The meaning of algorithms, Flowcharts, Pseudo codes, Writing algorithms and drawing flowcharts for simple exercises, Memory concepts, C Program development environment.	**05**
Unit 2	**C Fundamentals** Importance of 'C' Language, History, Structure of 'C' Program, Sample 'C' Program, Constants, variables and data types. Operators and expressions, Managing input / output operations, Control statements-Decision making, Case control & Looping Constructs.	**04**
Unit 3	**Array** Array, one dimensional and two dimensional arrays, declaration and initialization of arrays, reading , writing and manipulation of above types of arrays, multidimensional arrays. Strings-Declaring and initialing character array, reading and writing string to/from terminal, arithmetic operations on characters, putting strings together, and string handling functions.	**06**
Unit 4	**Functions** Need of user defined functions, elements of User defined functions, defining functions, return values and their types, function calls, function declaration, methods of parameter passing, Scope rule of functions, user defined and library functions.	**04**
Unit 5	**Structure & Pointers** Need of Structure, Defining a structure, declaring and accessing structure variables, structure initialization, copying and comparing structure variables, array of structures, structures and functions, Unions. Difference between	**04**

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	Structure & Union Understanding pointers, accessing the address space of a variable, declaring and initialization pointer variables, accessing a variable through its pointer, pointer expressions, pointers and arrays, pointer and character strings, pointer and structure	
Unit 6	**File Handling** Defining and opening a file, closing a file, input/output operations on files, file handling modes, error handling during I/O operations, random access files.	**05**

Course Contents: Laboratory

For completion of the Term Work student should have to perform following experiments:

- Write an algorithm and draw flowchart for given problem statement.
- Implement a program using different data types and operators in C.
- Implement a C program using Decision control statement.
- Implement a C program using Repetitive control statement.
- Implement a Program to demonstrate one dimensional and two dimensional Array.
- Implement a program to demonstrate String handling functions
- Implement a Program to demonstrate user-defined function in C.
- Implement a Program to demonstrate recursion in C(factorial, Fibonacci).
- Implement a program to demonstrate pointer and pointer arithmetic in C.
- Implement program to demonstrate structure and union in C
- Implement a program to demonstrate file handling in C.

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Programming And Problem Solving Using C Language	ISRD Group	McGraw-Hill Publications	2nd	2012
02	Let Us C	Yashwant Kanetkar	BPB	3rd	2011
03	C How to Program	Harvey M. Deitel, Paul J. Deitel, Abbey Deitel	Pearson	2nd	2009
04	Programming in ANSI C	E. Balguruswamy	Tata Mc-Graw Hill	4th	2008

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Reference Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	C: The Complete Reference	Herb Schildt	McGraw Hill Education	4th	2018
02	Modern C for Absolute Beginners: A Friendly Introduction to the C Programming Language	Slobodan Dmitrović	Apress	1st	2021
03	Introduction to C programming	Oxford University Press	Oxford University Press	2nd	2014
04	Introduction to computers and C programming.	S.K. Bajpai	Newagepublishers	1st	2002

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Course Details:

Class	F.Y. B.Tech: Semester-I
Course Code and Course Title	**2MEPC108, Workshop Practice - I**
Prerequisite/s	--
Teaching Scheme: Lecture/Tutorial/Practical	00/00/02
Credits	01
Evaluation Scheme: ISE/ESE	25/00

Course Outcomes : Upon successful completion of this course, the student will be able to:	
2MEPC108_1	**Identify** basic engineering practices and safety measures.
2MEPC108_2	**Select** appropriate measuring instruments and tools used in fitting, sheet metal and pipe fitting operations
2MEPC108_3	**Create** a male-female joint by carrying out different fitting operations.
2MEPC108_4	**Produce** a component using different sheet metal operations and tools.
2MEPC108_5	**Work** effectively in team to accomplish the assigned task.

Course Content:

1. Introduction to industrial safety, fire hazards, causes of accidents, safety precautions while working in shop, safety equipments and their uses.
2. Assignment on industrial safety.
3. Brief introduction to measuring instruments like – Steel rule, Calipers, Vernier Caliper, Micrometer, Vernier height Gauge etc. Least counts, common errors and care while using them, Use of marking gauge, 'V' block and surface plate.
4. Assignment on measuring instruments and their applications.
5. Dismantling, inspection and assembly of different products (e.g. three jaw chuck, hydraulic jack, screw jack, engine sub assembly etc.) using different tools and measuring instruments.
6. Study of various tools like- files, drills, taps, dies, fitting operations.
7. Assignment on different fitting tools and operations, types of files, tap, dies, drills.
8. Demonstration of die threading processes, pipe fittings with different joints (G.I. and PVC)
9. One job Male/Female fitting with operations- Marking, cutting, drilling, tapping, filling, etc. (One job per student)
10. Introduction to sheet metal work, specifications of metal sheet, working tools, sheet metal working operations like- cutting, bending, punching, riveting, joining by brazing and soldering.
11. Assignment on sheet metal work, tools and their operations.
12. One job like dust pan, tray, box, dust bin, book stopper in a group of 3 to 4 students.

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Text Books:					
Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Workshop Technology - I & II	SK Hajara Choudhury, AK Hajara Choudhury, Nirjhar Roy	MMP Pvt. Ltd.	14th	2003
02	Workshop Technology	Gupta and Kaushik,	New Heights	5th	2011
03	Workshop Practice	R. K. Rajput	Laxmi Publicatios Pvt. Ltd.	2nd	2008
04	Workshop Technology	Khurmi and Gupta	S. Chand Publications	1st	2006

Reference Books:					
Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Workshop Technology, Vol-I	B.S.Raghuvanshi	DhanpatRai and Sons	9th	2007
02	Workshop Practice	H.S.Bawa	TMH Publications, New Delhi	2nd	2012
03	Production Technology	P. C. Sharma	S. Chand Publications	11th	2011
04	Workshop Practice	Surendra D Ghatol Smith M Solanki	Nirali Prakashan	1st	2017

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Course Details:

Class	F.Y. B.Tech: Semester-I
Course Code and Course Title	**2MEHS109_A, Badminton**
Prerequisite/s	---
Teaching Scheme: Lecture/Tutorial/Practical	00 / 00 / 02
Credits	01
Evaluation Scheme: ISE/ESE	50 / 00

Course Outcomes: Upon successful completion of this course, the student will be able to:	
2MEHS109_A1	**Improve** physical fitness.
2MEHS109_A2	**Understand** the basic rules and how they can play the game of badminton.
2MEHS109_A3	**Provide** opportunities for playing modified games to promote student learning
2MEHS109_A4	**Develop** students' critical thinking skills, problem solving skills, self-management skills, collaboration skills, risk assessment etc.
2MEHS109_A5	**Learn** various technical motor skills in badminton and how you can move better in the court.
2MEHS109_A6	**Acquiring** a satisfactory level of knowledge and experience of the sport, to enable students to play by themselves for recreation.

Course Contents:		**Hrs.**
Unit 1	Introduction to badminton – Aim – Objectives – Short reference in Badminton history Understand the basic rules and how they should play normal game.	**04**
Unit 2	Skills - Service, Net shot, Clear, Drop, Smash. Skills - Service Forehand & Backhand, Net shot, Drive (Presentation and practice to the court)	**06**
Unit 3	Skills – Clear, Drop, Smash Implementation of singles rules	**05**
Unit 4	Footwork 1 Footwork 2	**05**
Unit 5	Implementation of doubles rules. Forehand strokes. Motor skills practice 1	**06**
Unit 6	Motor skills practice 2 Motor skills practice 3 Motor skills practice 4	**04**

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Course Details:

Class	F.Y. B.Tech: Semester-I
Course Code and Course Title	**2MEHS109_B,Volley Ball**
Prerequisite/s	---
Teaching Scheme: Lecture/Tutorial/Practical	00 / 00 / 02
Credits	01
Evaluation Scheme: ISE/ESE	50 / 00

Course Outcomes: Upon successful completion of this course, the student will be able to:	
2MEHS109_B1	**To** send the ball over the net, according to the regulations, to the ground on the opponents ground
2MEHS109_B2	**The** ball is put into play through the service right back player within the service zone
2MEHS109_B3	**The** Ball must hit with one hand or one arm and directly send over the net opponent's court.
2MEHS109_B4	**To** valley the ball over the net before it touches on the ground
2MEHS109_B5	**The** players use their hands to volley the ball.

Course Contents:		**Hrs.**
Unit 1	Introduction & Understand basic volleyball rules, terminology, and scoring procedures.	**04**
Unit 2	Demonstrate basic skills associated with volleyball, including passing, setting, serving, attacking (spiking), and blocking.	**06**
Unit 3	Demonstrate the ability to perform individual offensive and defensive skills and strategies.	**05**
Unit 4	Demonstrate an understanding of the typical game sequencing: serve, pass, attack, defense, transition, and defense.	**05**
Unit 5	Understand and apply the knowledge of basic rules of volley ball. Skill Practice	**06**
Unit 6	Demonstrate proper etiquette and good sportsmanship. And Skill related Practice. Skill Practice	**04**

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Course Details:

Class	F.Y. B.Tech: Semester-I
Course Code and Course Title	**2MEHS109_C, Kabaddi**
Prerequisite/s	---
Teaching Scheme: Lecture/Tutorial/Practical	00 / 00 / 02
Credits	01
Evaluation Scheme: ISE/ESE	50 / 00

Course Outcomes: Upon successful completion of this course, the student will be able to:	
2MEHS109_C1	**Acquire,** analyze and interpret basic skills
2MEHS109_C2	**Appraise** the rules and regulation.
2MEHS109_C3	**Demonstrate** and assess various basic skills/techniques and game strategies.
2MEHS109_C4	**Develops** confidence, concentration and tolerance in players.
2MEHS109_C5	**This** game also Provides an opportunity for healthy competitions among equal players and help them make friends.

Course Contents:		**Hrs.**
Unit 1	Introduction to Kabaddi – Aim – Objectives – Short reference in Kabaddi history Understand the basic rules and how they should play normal game.	**04**
Unit 2	Demonstrate basic skills associated with Kabaddi, including pushing, Bonus, Tackling, attacking, and blocking	**06**
Unit 3	Demonstrate an understanding of the typical game sequencing: service, Bonus, attack, defense, Raiding and defense.	**05**
Unit 4	Demonstrate the ability to perform individual offensive and defensive skills and strategies. Stepping Practice.	**05**
Unit 5	Skill Demo – Stepping, Bonus, Foot touch, Toe touch, Thrust, Squat leg, Kicks & Practice.	**06**
Unit 6	Skill Practice And Shadow Practice	**04**

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Course Details:

Class	F.Y. B.Tech: Semester-I
Course Code and Course Title	**2MEHS109_D, Foot Ball**
Prerequisite/s	---
Teaching Scheme: Lecture/Tutorial/Practical	00 / 00 / 02
Credits	01
Evaluation Scheme: ISE/ESE	50 / 00

Course Outcomes: Upon successful completion of this course, the student will be able to:	
2MEHS109_D1	**By** applying these principles through active participation, students develop the necessary Skills and knowledge to play football.
2MEHS109_D2	**Provides** students with opportunities to improve physical fitness acquire knowledge of fitness concepts and practice positive personal and social skills.
2MEHS109_D3	**Students** will gain an understanding of how a wellness lifestyle affects one's health, fitness and physical performance

Course Contents:		**Hrs.**
Unit 1	Introduction to Football – Aim – Objectives – Short reference in Football history Understand the basic rules and how they should play normal game.	**04**
Unit 2	Introduce students to the basic skills and knowledge associated with football. Understand basic football rules, terminology, and safety concerns.	**06**
Unit 3	Demonstrate the basic football skills of passing, three point stance, catching, blocking, hand-offs, punting, the carry and kicking & Practice.	**05**
Unit 4	Demonstrate the ability to perform individual offensive and defensive skills and strategies.	**05**
Unit 5	Improve personal fitness through participation in yoga, muscular strength, muscular endurance, and flexibility activities & Practice.	**06**
Unit 6	Successfully participates in skill improvement and offensive game strategies & Practice	**04**

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Course Details:

Class	F.Y. B.Tech: Semester-I
Course Code and Course Title	**2MEHS109_E, Bharatnatyam Classical Dance**
Prerequisite/s	---
Teaching Scheme: Lecture/Tutorial/Practical	00 / 00 / 02
Credits	01
Evaluation Scheme: ISE/ESE	50 / 00

Course Outcomes: Upon successful completion of this course, the student will be able to:	
2MEHS109_E1	**Interpolation** of Indian classical dance forms & basic types of Bharatnatyam.
2MEHS109_E2	**Subdivide** bharatnatyam in terms of Nrutt, Nrutya & Nattya.
2MEHS109_E3	**Show** the perform base on signal & combine hand posture in terms of Ganesh Vandana & Mahalaxmi Ashtak

Course Contents:		**Hrs.**
Unit 1	History of Bharatnatyam Dance style & information about all Indian classical dance forms.	**01**
Unit 2	Basic types of Bharatnatyam: - Tatty Advu, Natty advu, Vishruadvu, Kuddit Mettadvu, Mettadvu, tattikudditmettadvu & Tirmanam (small). Study of Navras Abhinay. Single Hand posture, Footwork, Shirobhed (head movement),	**10**
Unit 3	Combine Hand posture. Meaning of Guruvandna, Ganesh, mahalaxmi shlok. Definition of Nrutt, Nrutya & Nattya.	**06**
Unit 4	Practical session of Ganeshvandna Shlok in classical music.	**06**
Unit 5	Practice Sessions. & Presentation of Ganesh vandna	**07**
Unit 6	History of Bharatnatyam Dance style & information about all Indian classical dance forms.	**01**

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Course Details:

Class	F.Y. B.Tech: Semester-I
Course Code and Course Title	**2MEHS109_F, Harmonium Classical Music**
Prerequisite/s	---
Teaching Scheme: Lecture/Tutorial/Practical	00 / 00 / 02
Credits	01
Evaluation Scheme: ISE/ESE	50 / 00

Course Outcomes: Upon successful completion of this course, the student will be able to:	
2MEHS109_F1	**Outline** in History Harmonium & different Ragas.
2MEHS109_F2	**Perform** on different songs
2MEHS109_F3	**Role** plays the different music by means of harmonium.

Course Contents:		**Hrs.**
Unit 1	History & Introduction of Harmonium.	**02**
Unit 2	Harmonium presentation of Raag:-Bhoopraag / Bhimpalash raag.	**12**
Unit 3	Practice sessions.	**03**
Unit 4	Practice song notations & Harmonium Dhoon (percussion)	**08**
Unit 5	Practice sessions & students presentations	**05**
Unit 6	History & Introduction of Harmonium.	**02**

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Course Details:

Class	F.Y. B.Tech: Semester-I
Course Code and Course Title	**2MEHS109_G, Indian Folk Dance**
Prerequisite/s	---
Teaching Scheme: Lecture/Tutorial/Practical	00 / 00 / 02
Credits	01
Evaluation Scheme: ISE/ESE	50 / 00

Course Outcomes: Upon successful completion of this course, the student will be able to:	
2MEHS109_G1	**Discuss** different types in Indian Folk dance.
2MEHS109_G2	**Demonstrate** Navras Abhinay, Tribal dance, Dhangari & Lavni dance.
2MEHS109_G3	**Compose** dance on different folk dance style.

Course Contents:		**Hrs.**
Unit 1	Introduction to Indian Folk dance & its forms.	**02**
Unit 2	Basic steps of folk dance styles.	**03**
Unit 3	Importance of expressions (Acting) in dance, Navras Abhinay & its types. (9 type of navras)	**03**
Unit 4	Tribal dance, & its different styles.	**06**
Unit 5	Practice sessions.	**04**
Unit 6	History of Dhangari & Lavni dance. Types of dhangari & lavni dance.	**01**
Unit 7	Steps (dance composition) of Dhangari & Lavni dance.	**07**
Unit 8	Practice sessions & Students performance	**04**

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Course Details:

Class	F.Y. B.Tech: Semester-I
Course Code and Course Title	**2MEHS109_H, Karaoke Singing.**
Prerequisite/s	---
Teaching Scheme: Lecture/Tutorial/Practical	00 / 00 / 02
Credits	01
Evaluation Scheme: ISE/ESE	50 / 00

Course Outcomes: Upon successful completion of this course, the student will be able to:	
2MEHS109_H1	**Understand** notation of the songs.
2MEHS109_H2	**Perform** happy, sad, love deviational, patriotic songs.
2MEHS109_H3	**Compose** songs in many variations.

Course Contents:		**Hrs.**
Unit 1	Song Notation	**04**
Unit 2	Happy song / Sad song (classical & semi classical)	**08**
Unit 3	Love song / Deviational song / Patriotic songs	**08**
Unit 4	Song composition	**05**
Unit 5	Practice session & students presentation	**05**

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Teaching and Evaluation Scheme

F. Y. B. Tech Semester II

Course Code	Course Name	Teaching Scheme				THEORY							PRACTICAL						GRAND TOTAL
						ISE		MSE+ ESE			Total	Min	ISE		ESE		Total	Min	
		L	T	P	Credits	Max	Min	MSE	ESE	Min			Max	Min	Max	Min			
2MEBS110	Applied Physics	3	-	-	3	40	16	30	30	24	100	40	-	-	-	-	-	-	100
2MEBS111	Applied Mathematics-II	3	1	-	4	40	16	30	30	24	100	40	-	-	-	-	-	-	100
2MEES112	Applied Mechanics	3	1	-	4	40	16	30	30	24	100	40	-	-	-	-	-	-	100
2MEVS113	Computer Programming Using C++	2	-	-	2	40	16	30	30	24	100	40	-	-	-	-	-	-	100
2MEHS114	Professional Communication Skill Laboratory	-	-	4	2	-	-	-	-	-	-	-	50	20	-	-	50	20	50
2MEBS115	Applied Physics Laboratory	-	-	2	1	-	-	-	-	-	-	-	25	10	-	-	25	10	25
2MEVS116	Computer Programming Using C++ Laboratory	-	-	2	1	-	-	-	-	-	-	-	25	10	25	10	50	20	50
2MEPC117	Workshop Practice-II	-	-	2	1	-	-	-	-	-	-	-	25	10	-	-	25	10	25
2MEES118	Design Thinking Laboratory	1	-	2	2	-	-	-	-	-	-	-	50	20	-	-	50	20	50
2MEHS119	Value added Course	-	-	2	1	-	-	-	-	-	-	-	50	20	-	-	50	20	50
		12	2	14	21														650
	Total Contact Hours	**28**																	

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Course Details:

Class	F.Y. B.Tech: Semester-II
Course Code and Course Title	**2MEBS110, Applied Physics**
Prerequisite/s	--
Teaching Scheme: Lecture/Tutorial/Practical	03/00/00
Credits	03
Evaluation Scheme: ISE/MSE/ESE	40/30/30

Course Outcomes : Upon successful completion of this course, the student will be able to :	
2MEBS110_1	**Apply** suitable optical theory to determine wavelength and divergence of monochromatic and polychromatic sources of light using relevant optical methods of testing.
2MEBS110_2	**Calculate** the interplaner spacing, lattice constant and properties of unit cell for a given crystal system based on the crystallographic study using laws of material science.
2MEBS110_3	**Use** concept of Nanotechnology to express Production technique and tools of nano material using different synthesis methods and microscopes.
2MEBS110_4	**Solve** engineering problems based on Architectural acoustics and Ultrasonic's using appropriate theories and formulae.
2MEBS110_5	**Apply** principles of Quantum mechanics to analyze observables on known wave functions using fundamental quantum mechanical processes in nature.

Course Contents:		**Hrs.**
Unit 1	**Wave Optics :** **Diffraction:**-Introduction, construction of plane diffraction grating, Diffraction at multiple slits, Determination of wavelength of particular colour using plane diffraction grating, Resolving power of grating, Numericals. **Polarization:**-Polarization of light, Polarization by double refraction, Positive and Negative crystals, Optical activity, Laurent's half shade Polarimeter, Numericals.	**07**
Unit 2	**Laser and Fiber Optics :** **Laser**: Introduction to laser, Laser and ordinary light, Interaction of radiation with matter- Absorption, Spontaneous emission, Stimulated emission, Pumping(Three level and four level), Population inversion, Metastable state, Laser beam Characteristics, Solid State laser (Ruby Laser), Industrial and medical applications of laser, Holography- Difference between ordinary photography and Holography, Construction and reconstruction of Hologram. **Optical fiber**: Introduction, Basic principle (total internal reflection), Structure of optical fiber, Propagation of light through optical fiber, Acceptance angle and acceptance cone (no derivation), Fractional refractive index change, Numerical aperture (no derivation), Classification of optical fiber, Advantages and disadvantages of optical fiber, Applications of optical fibers, Numericals.	**07**

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Unit 3	**Structure of Solids and its Characterization:** Crystalline state, Lattice, Space lattice, Basis and crystal structure, Unit cell, lattice parameters, Crystal system in brief,(Cubic, Monoclinic...Triclinic), Fourteen Bravais lattices, Properties of unit cell (number of atoms per unit cell, coordination number, atomic radius, packing fraction), Calculation of lattice constant(Relation between lattice constant and density), Symmetry elements in cubic crystal, Miller indices:- Procedure, Features and Sketches for different planes. **X-ray diffraction** (Laue method), Bragg's law, Bragg's X-ray diffractometer, Numericals.	**08**
Unit 4	**Nano Physics:** Introduction, Concept of nanotechnology, Production techniques:- Top-down (eg. Ball milling) and Bottom-up (eg. Sol-gel process), Tools – Scanning Electron Microscope (SEM) and Atomic Force Microscope (AFM), Applications of nano- materials, Carbon Nano Tube (CNT):- Structure, two types, properties and applications.	**06**
Unit 5	**Architectural acoustics and Ultrasonic :** **Architectural Acoustics**: Introduction, Basic requirements for acoustically good hall, Reverberation, Time of Reverberation, Sabine's formula (no derivation),Absorption coefficient, Factors affecting the architectural acoustics and their remedy, , Numericals. **Ultrasonic waves:** Introduction, Properties of ultrasonic waves, Production of ultrasonic waves by magneto striction method, Determination of wavelength and velocity of ultrasonic waves by using acoustic diffraction method, Detection of ultrasonic waves, Applications of ultrasonic waves, Numericals. **Microwaves-** Properties, Advantages, Disadvantages and its applications.	**08**
Unit 6	**Quantum Physics:** Introduction to Quantum mechanics, Plank's Quantum Theory, Photoelectric Effect, Compton Effect with theory, Wave Particles Duality, Matter waves, Properties of Matter wave, Heisenberg Uncertainty principle for position and momentum of particle, Problems.	**06**

Text Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
01	Engineering Physics	G Vijayakumari	Vikas Pub. House (P) Ltd	3rd	2009
02	A Text Book of Engineering Physics	M.N.Avadhanulu& P. G. Kshirsagar	S. Chand Publication.	12th	2006
03	Engineering Physics	P. K. Palanisamy	Sci Tech pub. (P) Ltd.	2nd	2009
04	Introduction to Nano science and Nanotechnology:	K.K. Chattopadhyay and A.N. Banerjee,	PHI Learning	3rd	2009

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Reference Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Engineering Physics	ResnickHalliday, Krane,	John Wiley & Sons Pub.	8th	2008
02	Engineering Physics	R. K. Gaur & Gupta S. L	Dhanapat Rai Publication	8th	2008
03	Solid State Physics:	S. O. Pillai	New Age International Ltd.	6th	2007
04	Introduction to Solid State Physics	Charles Kittle,	Wiley India Pvt. Ltd	7th	2008
05	Materials Science and Engineering –	V. Raghvan,	PHI Learning.	5th	2006

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Course Details:

Class	F.Y. B.Tech: Semester-II
Course Code and Course Title	**2MEBS111, Applied Mathematics-II**
Prerequisite/s	--
Teaching Scheme: Lecture/Tutorial/Practical	03/01/00
Credits	04
Evaluation Scheme: ISE/MSE/ESE	40/30/30

Course Outcomes: Upon successful completion of this course, the student will be able to:	
2MEBS111_1	**Solve** problems on partial derivatives by using fundamental concepts of derivative and apply it to find Jacobian, Maxima and Minima of functions of
2MEBS111_2	**Solve** Ordinary Differential Equation by using analytical method and numerical techniques.
2MEBS111_3	**Apply** the concept of Special Functions to evaluate improper integrals.
2MEBS111_4	**Evaluate** proper and improper type of multiple integrals by using fundamental concepts of integration and apply it to find Area and Mass of a given region.
2MEBS111_5	**Solve** problems in probability theory using distributions.

Course content		**Hrs.**
Unit 1	**Partial Differentiation and Its Applications:** Function of two or more variables, Partial derivatives, Euler's theorem, Change of variables, Jacobin, Maxima and minima of functions of two variables.	**08**
Unit 2	**Ordinary Differential Equation (First order and First degree):** Linear differential equation, Equation reducible to linear differential equation, Exact differential equation, Equation reducible to exact equation, Simple electrical circuits.	**07**
Unit 3	**Numerical Solution of Ordinary Differential Equation (First order and First degree):** Picard's method, Taylor's series method, Euler's method, modified Euler's method, Runge-Kutta method.	**06**
Unit 4	**Finite Differences and Interpolation:** Finite differences, Newton's Interpolation formulae, central difference interpolation formulae (stirling formula), interpolation with unequal interval (Lagrange's formula)	**06**
Unit 5	**Special Functions:** Gamma function, Properties of Gamma function, Beta function, Properties of Beta function, Relation between Beta and Gamma functions.	**08**
Unit 6	**Multiple Integral and Its Applications:** Double Integrals, Triple integral, Change of Order of Integration, Change to polar, Applications to Area and Mass of plane lamina.	**07**

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Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Higher Engineering Mathematics	Dr. B. S. Grewal	KhannaPublishers	44th	2018
02	Advanced Engineering Mathematics	N. P. Bali, Manish Goyal	Infinity science press	7th	2010
03	Probability and Statistics for Engineers	Dr. J. Ravichandran	Wiley	1st	2012
04	Numerical Methods in Engineering & Science	Dr. B. S Grewal	KhannaPublishers	9th	2010

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	A textbook of Applied Mathematics	P. N. Wartikar & J. N. Wartikar	Pune VidyarthiGrihaPrakashan	1st	2008
02	Higher Engineering Mathematics	B. V. Ramana	Tata McGraw Hill Publ.	6th	2010
03	Advanced Engineering Mathematics	Erwin Kreyszig	Wiley Publishers	10th	2017
04	Numerical Methods	Dr. P. Kandasamy, Dr. K.Thilagavathy, Dr. K. Gunavathi	S. Chand	1st	2010

List of Tutorial:

Sr. No.	Title of Tutorials
01	Partial Differentiation and Its Applications
02	Partial Differentiation and Its Applications
03	Ordinary Differential Equation
04	Ordinary Differential Equation
05	Numerical Solution of Ordinary Differential Equation
06	Special functions
07	Special functions
08	Multiple Integrals

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Course Details:

Class	F.Y. B.Tech: Semester-II
Course Code and Course Title	**2MEES112, Applied Mechanics**
Prerequisite/s	--
Teaching Scheme: Lecture/Tutorial/Practical	03/01/00
Credits	04
Evaluation Scheme: ISE/MSE/ESE	40/30/30

Course Outcomes: Upon successful completion of this course, the student will be able to:	
2MEES112_1	**Interpret** the resultant force for a force system based on concepts of resolution and composition.
2MEES112_2	**Sketch** shear force and bending moment diagram for a beam under different loading conditions.
2MEES112_3	**Calculate** the forces in members of roof truss under point load by using analytical methods.
2MEES112_4	**Compute** moment of inertia for a composite plane lamina by using parallel and perpendicular axis theorem.
2MEES112_5	**Apply** the concept of dynamic equilibrium to analyze rigid bodies by using equations of motion.

Course Contents:		**Hrs.**
Unit 1	**Introduction to Engineering mechanics:** Basic concept - Particle, rigid body, force system, types of force system, law of transmissibility of force, resolution of a force, composition of forces, resultant force, moment of force, Varignon's theorem.	**07**
Unit 2	**Beam in Equilibrium:** Concept of Equilibrium- equations of equilibrium of coplanar force system Beam: Types of beam, types of support for beam, types of load acting on beam, reactions at support, shear force, bending moment, relation between load, shear force and bending moment, shear force and bending moment diagram for statistically determinate beam (simply supported, cantilever, overhanging beam) subjected to different loading conditions.	**08**
Unit 3	**Analysis of Truss :** Introduction of roof truss, Types of Trusses, Determinacy of a Truss, Assumptions for analysis of truss, Analysis of truss using method of Joint and method of Section.	**06**
Unit 4	**Centroid and Moment of Inertia :** Introduction to centroid and center of gravity, centroid of plain lamina, moment of inertia of standard shapes from first principle, parallel and perpendicular axis theorem, Moment of inertia of composite section, radius of gyration.	**07**

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Unit 5	**Kinematics of linear and circular motion :** Introduction to dynamics, kinematics of linear motion, Newton's 2nd law of motion, motion under gravity, motion under variable acceleration, kinematics of circular motion, super elevation, angle of banking.	**07**
Unit 6	**Kinetics of linear and circular motion:** Kinetics of linear motion, D'Alembert's principle and its applications in plane motion and connected bodies, work - energy principle, work done by spring, impulse – momentum principle, friction force, torque, Newton's law for rotary motion, power.	**07**

Text Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
01	Engineering Mechanics	S. Ramamrutham	Dhanpat Rai Publishing Company (P). Ltd	9th	2010
02	Engineering Mechanics	R.S. Khurmi	S. Chand	3rd	2006
03	Engineering Mechanics	R. K. Bansal and Sanjay Bansal	Laxmi Publications Pvt. Ltd.	6th	2013
04	Engineering Mechanics	S. B. Junnarkar	Charotar Publications	16th	2011
05	Engineering Mechanics	S.S. Bhavikatti	New Age International Pvt. Ltd.	4th	2012
06	Strength of Materials	R. K. Bansal	Laxmi Publications	6th	2011

Reference Books

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Engineering Mechanics	Irving H. Shames	Prentice Hall of India, New Delhi	5th	2011
02	Vector Mechanics for Engineers Vol.-I and II	F. P. Beer and E. R. Johnson	Tata McGraw Hill Education	6th	2011
03	Strength of Materials	B. K. Sarkar	McGraw Hill Pub.	2nd	2007
04	Engineering Mechanics: Statics & Dynamics	Ferdinand Singer	Harper and Row Publications	9th	2009

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Course Details:

Class	F.Y. B.Tech: Semester-II
Course Code and Course Title	**2MEVS113, Computer Programming Using C++**
Prerequisite/s	--
Teaching Scheme: Lecture/Tutorial/Practical	02/00/00
Credits	02
Evaluation Scheme: ISE/MSE/ESE	40/30/30

Course Outcomes: Upon successful completion of this course, the student will be able to:	
2MEVS113_1	**Explain** object-oriented programming concept.
2MEVS113_2	**Illustrate** the concept of class and object in programs.
2MEVS113_3	**Explain** concept of Inheritance for reusability.
2MEVS113_4	**Define** concept of overloading and polymorphism for solving the task in C++.
2MEVS113_5	**Apply** their knowledge and programming skills to solve various graphical and mechanical problems.

Course Contents:		**Hrs.**
Unit 1	**Introduction to Object Oriented Programming** Introduction to object-oriented structure, Basic concepts of object oriented language, Difference between structured and Object oriented language, Benefits and applications of Object oriented programming.	**04**
Unit 2	**Classes and Objects** Introduction of class, Declaration of class, Defining object of class, Data members and member functions, Accessing members of class, Friend function, friend Class.	**04**
Unit 3	**Inheritance** Single Inheritance, multilevel Inheritance, multiple Inheritance, hybrid Inheritance, hierarchical Inheritance.	**04**
Unit 4	**Overloading and Polymorphism** Concept of overloading: Operator overloading, function overloading, Virtual functions, Pure virtual function, Virtual base classes, Abstract classes, Early vs. Late binding.	**05**
Unit 5	**File and Streams:** Overview of C++ Stream classes, File handling modes, Read File using stream classes, Write into file using stream classes.	**04**
Unit 6	**Programming on Computer graphics and Mechanical applications** Introduction to computer graphics, Draw line, circle, triangle, rectangle, 2D transformation and 3D transformation, programming on Newton Rapson Method, RungeKutta Method, Euler's Method.	**07**

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Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Object-Oriented Programming with C++	E. Balagurusamy	Tata McGraw Hill	5th	2011
02	Let us C++	Yashwant Kanitkar	BPB Publication	2nd	2010
03	Computer Graphics	Hearn and Baker	Dorling Kindersley pvt. Ltd.	2nd	1997
04	Object-Oriented Programming in C++	Rajesh K. Shukla	Wiley India Pvt. Ltd.	1st	2008

Reference Books

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Object oriented programming in C++	Robert Lafore	Pearson Education	4th	2008
02	Programming with C++	D. Ravichandran	Tata McGraw Hill	2nd	2008
03	The C++ programming Language	BjarneStroustrup	Pearson Education	3rd	2008
04	The Complete Reference: C++	Herbert Schildt	Tata McGraw Hill	4th	2008
05	Professional C++	Marc Gregoire	Wiley India Pvt. Ltd.	3rd	2015

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Course Details:

Class	F.Y. B.Tech- Semester-II
Course Code and Course Title	**2MEHS114, Professional Communication Skill Laboratory**
Prerequisite/s	12th Standard English Grammar
Teaching Scheme: Lecture/Practical	00/00/04
Credits	02
Evaluation Scheme: ISE/ESE	50/00

Course Outcomes: Upon successful completion of this course, the student will be able to:	
2MEHS114_1	**Exhibit** the skill of sentence construction considering the frame of English language rules accurately for effective and sound communication.
2MEHS114_2	**Present** their portfolio confidently considering SWOT analysis by using digital tools convincingly as per the corporate expectations.
2MEHS114_3	**Write** formal letters proficiently by following required techniques that helps in maintaining professional affairs at workplace.
2MEHS114_4	**Produce** professional presentations proficiently on assigned topics in convincing manner using necessary tools and techniques.
2MEHS114_5	**Justify** own role in communicative events with balanced zeal, in well-organized manner.

Course Contents:

01 Checking My English Communication
02 Self - Introduction
03 Presenting my Career Choices
04 Preparing my Portfolio
05 Understanding Sentence Pattern
06 Avoiding Common Errors
07 Presenting My Portfolio
08 Note Making
09 Getting Smart with Technical Description of charts/ Images/ Processes
10 Delivering Professional Presentation
11 Application and Resume Writing
12 Email Writing
13 GD (General)
14 Introducing Guest/ Friend
15 Extempore
16 GD (Technical)
17 Mock Interview
18 Organizing Event

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Textbook					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	The Professional: Defining the New Standard of Excellence at Work	Subroto Bagchi	Penguin Books India Pvt. Ltd.	1st	2011
02	Cambridge Guide to IELTS	Pauline Cullen, Amanda French	Cambridge University Press	2nd	2017
03	A Practical Course in Effective English Speaking Skills	J. K. Gangal	PHI Learning Private Limited, New Delhi	5th	2012
04	Personality Development and Soft Skills	Barun K. Mitra	Oxford University Press, New Delhi , India	7th	2012

Reference Books					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	High-school English Grammar and Composition	Wren and Martin	S. Chand and Co., New Delhi	1st	2015
02	The Ace of Soft Skills	AjaiChowdary, BalaBalchandran	Pearson Publication, Delhi	8th	2013
03	Effective Technical Communication	M. Ashraf Rizvi	McGraw Hill Education, Chennai	2nd	2017
04	Business Communication	HorySankarMukerjee	Oxford University Press, New Delhi , India	2nd	2013

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Course Details

Class	F.Y. B.Tech- Semester-II
Course Code and Course Title	**2MEBS115, Applied Physics Laboratory**
Prerequisite/s	--
Teaching Scheme: Lecture/Tutorial/Practical	00/00/02
Credits	01
Evaluation Scheme: ISE/ESE	25/00

Course Outcomes : Upon successful completion of this course, the student will be able to:	
2MEBS115_1	**Build** an experimental set up to Calculate wavelength and angular Divergence of different sources of light accurately using appropriate optical methods in organized manner.
2MEBS115_2	**Calculate** band gap energy and Specific rotation for a given semiconductor and sugar solution using appropriate theories and formulae.
2MEBS115_3	**Demonstrate** Symmetries, planes and properties of unit cell for a given crystal system based on the crystallographic study using laws of material science.
2MEBS115_4	**Communicate** effectively about laboratory work both orally and writing.
2MEBS115_5	**Practice** professional and ethical behavior to carry forward in their life.

Course Contents:

Expt. No.	Title of the Experiment
01	Plane Diffraction Grating
02	Resolving power of Grating
03	Resolving power of telescope
04	Laurent's Half Shade Polarimeter
05	Kund's tube for determination of velocity of sound
06	Divergence of The LASER Beam
07	Wavelength of LASER
08	Inverse Square Law
09	Band Gap energy
10	Seven Crystal System
11	Symmetry Element of Cube
12	Numerical aperture of optical fibre
13	Double Refraction
14	Material Characterization using ultrasound.

Minimum **EIGHT** experiments should be perform from the above list.

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Text Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
01	Engineering Physics	G Vijayakumari	Vikas Pub. House (P) Ltd	3rd	2009
02	A Text Book of Engineering Physics	M.N. Avadhanulu & P. G. Kshirsagar	S. Chand Publication.	12th	2006
03	Engineering Physics	P. K. Palanisamy	Sci Tech pub. (P) Ltd.	2nd	2009
04	Introduction to Nano science and Nanotechnology:	K. K. Chattopadhyay and A.N. Banerjee,	PHI Learning	3rd	2009

Reference Books:					
Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Fundamentals of Physics	Resnick Halliday and Walker	John Wiley & Sons Pub.	9th	2011
02	Concepts of Modern Physics	A Besir	McGraw Hill International	5th	2003
03	Solid State Physics:	S. O. Pillai	New Age International Ltd.	6th	2007
04	Introduction to Solid State Physics	Charles Kittle,	Wiley India Pvt. Ltd	7th	2008
05	Optics	Ajoy Ghatak	Tata McGraw Hill	5th	2012
06	Engineering Physics:	D.K. Bhattacharya and A. Bhaskaran,	Oxford University Press	6th	2010

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Course Details:

Class	F.Y. B. Tech, Semester - II
Course Code and Course Title	**2MEVS116, Computer Programming Using C++ Laboratory**
Prerequisite/s	0MEES105, 0MEES153
Teaching Scheme: Lecture/Tutorial/Practical	00/00/02
Credits	01
Evaluation Scheme: ISE/ESE	25/25

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
2MEVS116_1	**Explain** the basic concept of object-oriented programming.
2MEVS116_2	**Apply** the concepts of class, object, inheritance, overloading, polymorphism and transformation in C++.
2MEVS116_3	**Develop** programming skills to solve problems using object-oriented concept in Turbo C++.
2MEVS116_4	**Communicate** effectively, both orally and in writing journals and complete assigned tasks in team.
2MEVS116_5	**Follow** given instructions during practical performance.
2MEVS116_6	**Engage** in independent and life-long learning in the programming domain.

Course Contents:

For completion of the Term Work student should have to perform following experiments:

- Simple programs on C++, Creation of source files, Compile and Linking.
- Programs on implementation of class object and structure.
- Program on constructor and destructor.
- Program on friend function.
- Program on friend class
- Programs on single inheritance, multilevel inheritance and multiple inheritance.
- Programs on Hierarchical Inheritance & Hybrid Inheritance.
- Programs on function overloading and operator overloading.
- Programs on Virtual Function and Virtual Class concept.
- Program for File Handling. (Read Write Operations)
- Simple programs to draw line, circle, triangle etc.
- Programs on 2D, 3D transformation like scaling, translation, rotation.
- Programs on solving mechanical problems 1(Newton Raphson Method).
- Programs on solving mechanical problems 2(RungeKutta and Euler's Method).

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Text Books:					
Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Object-Oriented Programming with C++	E. Balagurusamy	Tata McGraw Hill	5th	2011
02	Let us C++	YashwantKanitkar	BPB Publication	2nd	2010
03	Computer Graphics	Hearn and Baker	Dorling Kindersley pvt. Ltd.	2nd	1997
04	Object-Oriented Programming in C++	Rajesh K. Shukla	Wiley India Pvt. Ltd.	1st	2008

Reference Books:					
Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Object oriented programming in C++	Robert Lafore	Pearson Education	4th	2008
02	Programming with C++	D. Ravichandran	Tata McGraw Hill	2nd	2008
03	The C++ programming Language	BjarneStroustrup	Pearson Education	3rd	2008
04	The Complete Reference: C++	Herbert Schildt	Tata McGraw Hill	4th	2008
05	Professional C++	Marc Gregoire	Wiley India Pvt. Ltd.	3rd	2015

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Course Details:

Class	F.Y. B.Tech- Semester-II
Course Code and Course Title	**2MEPC117, Workshop Practice-II**
Prerequisite/s	2MEES254
Teaching Scheme: Lecture/Tutorial/Practical	00/00/02
Credits	01
Evaluation Scheme: ISE/ESE	25/00

Course Outcomes : Upon successful completion of this course, the student will be able to:	
2MEPC117_1	**Identify** basic engineering practices and safety measures.
2MEPC117_2	**Select** appropriate measuring instruments and tools used in welding, carpentry and smithy.
2MEPC117_3	**Prepare** different jobs using electric arc welding and smithy.
2MEPC117_4	**Produce** a wooden job using different carpentry operations and tools.
2MEPC117_5	**Work** effectively in team to accomplish the assigned task.

Course Content:

1. Introduction to types of welding, gas welding, electric arc welding, resistance welding, welding equipment's, welding of various metals, electrodes classification and coding, welding joints.
2. Assignment on types of welding, types of joints.
3. Hands on practice on TIG/MIG welding for different materials.
4. One job on arc welding – Lap, butt, L joint (For individual student) or table, shoe stand, bag stand (In a group of 4 to 6 students)
5. Introduction to carpentry – classification of wood, carpentry tools – marking tools, cutting tools, striking tools, carpentry operations – marking, sawing, chiseling, grooving, etc, carpentry joints.
6. Assignment on carpentry tools, carpentry operations and joints.
7. One composite job involving dovetail joint, T joint, cross halving joint, pen stand etc. (For individual student) or Table, Teapot, stool etc. (In a group of 4 to 6 students).
8. Introduction to smithy operations like bending, forming, upsetting, drawing, smithy tools – hammer, hot and cold chisel flatter, tongs, anvil, etc.
9. Assignment on smithy tools and operations.
10. One job in smithy involving upsetting, drawing, bending such as – hooks, square headed bolt etc.

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Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Workshop Technology-I & II	S.K Hajara Choudhury, A.K Hajara Choudhury, Nirjhar Roy	MMP Pvt. Ltd.	14th	2003
02	Workshop Technology	Gupta and Kaushik,	New Heights	1st	2005
03	Workshop Practice	R. K. Rajput	LaxmiPublicatios Pvt. Ltd.	2nd	2008
04	Workshop Technology	Khurmi and Gupta	S. Chand Publications	1st	2006

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Workshop Technology, Vol-I	B. S. Raghuvanshi	DhanpatRai and Sons	9th	2007
02	Workshop Practice	H.S. Bawa	TMH Publications, New Delhi	2nd	2012
03	Production Technology	P. C. Sharma	S. Chand Publications	11th	2011
04	Workshop Technology, Part -1	W A J Chapman	CBS	5th	2016

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Course Details

Class	F.Y. B.Tech- Semester-II
Course Code and Course Title	**2MEES118, Design Thinking Laboratory**
Prerequisite/s	--
Teaching Scheme: Theory/Tutorial/Practical	01/00/02
Credits	02
Evaluation Scheme: ISE/ESE	50

Course Outcomes: After successful completion of this course the students will be able to	
2MEES118_1	**Apply** the design thinking techniques to empathize the customer through arranging survey and/or interviews.
2MEES118_2	**Identify** and formulate the solution for real world problem using design thinking technique.
2MEES118_3	**Create** a Prototype for defined problem using design thinking approach.
2MEES118_4	**Test** developed prototype to meet user's requirements through customer **feedback** or prototype exhibitions.
2MEES118_5	**Adapt** ethical practices and professional skills to provide a reliable solution for defined real world problem through participating in team activities.

Course Content:

Course Contents		**Hrs.**
Unit 01	Introduction to Design Thinking, Design Thinking Process	**02**
Unit 02	Empathize Phase: Empathy and Ethics, User Perspective, Activities – Empathy Map, Planning, Persona building.	**02**
Unit 03	Customer Journey Mapping, Observation of stakeholders, Defining and Conceptualization of problem	**02**
Unit 04	Ideation, Activities –5 Whys & 1 How, Story boarding, Brainstorming.	**02**
Unit 05	Prototype – Types, Mindsets, Tools.	**02**
Unit 06	Testing – Scenario, Methods, Refinements &Recommendations.	**02**

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Text Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
01	Understanding Design Thinking, Lean, and Agile	Jonny Schneider	O'Reilly	---	2017
02	Introduction to Design Thinking	S.Salivahanan, S.Suresh Kumar, D.Praveen Sam,	Tata McGraw Hill,	---	2019
03	Karmic Design Thinking - A Buddhism-Inspired Method to Help Create Human-Centered Products & Services	Prof. BalaRamadurai,	Self-Published	--	2020
04	Design: Creation of Artifacts in Society	Prof. Karl Ulrich, U. Penn	University of Pennsylvania	--	2011

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Design for How People Think	John Whalen	O'Reilly	---	2019
02	Change by Design	Tim Brown	HarperCollins	---	2009
03	Creative Confidence: Unleashing the Creative Potential Within Us All	Kelley, D. & Kelley, T	New York: William Collins	---	2014
04	Sprint: How to Solve Big Problems and Test New Ideas in Just Five Days	Jack Knapp and others	Simon & Schuster	---	2009

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Course Details:

Class	F.Y. B.Tech: Semester-II
Course Code and Course Title	**2MEHS119_A, Table –Tennis**
Prerequisite/s	---
Teaching Scheme: Lecture/Tutorial/Practical	00 / 00 / 02
Credits	01
Evaluation Scheme: ISE/ESE	50 / 00

Course Outcomes: Upon successful completion of this course, the student will be able to:	
2MEHS119_A1	**The** students define table tennis game.
2MEHS119_A2	**Willingly** participates in Table Tennis as a component of an active lifestyle.
2MEHS119_A3	**The** students explain foot- work in forehand and backhand spin.

Course Contents:		**Hrs.**
Unit 1	Introduction & Understand basic Table Tennis rules, terminology, safety concerns, and scoring procedures.	**04**
Unit 2	Demonstrate proper court etiquette and good sportsmanship.	**06**
Unit 3	Demonstrate basic skills associated with table tennis including forehand, backhand, spins, grips & serves.	**05**
Unit 4	Demonstrate Exposition and Applying forehand and backhand straight strike.	**05**
Unit 5	Assess current personal fitness levels & Practice.	**06**
Unit 6	Use a variety of stroke placements to keep opponent moving during a table tennis match Practice.	**04**

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Course Details:

Class	F.Y. B.Tech: Semester-II
Course Code and Course Title	**2MEHS119_B, Kho-Kho**
Prerequisite/s	--
Teaching Scheme: Lecture/Tutorial/Practical	00 / 00 / 02
Credits	01
Evaluation Scheme: ISE/ESE	50 / 00

Course Outcomes: Upon successful completion of this course, the student will be able to:	
2MEHS119_B1	**Helps** In Motor Development.
2MEHS119_B2	**It** helps in social and mental development of the student
2MEHS119_B3	**Kho-Kho** helps the student to off depression, anxiety, stress and, increase self-esteem.
2MEHS119_B4	**It** develops team spirit and leadership skill.
2MEHS119_B5	**It** improves physical fitness.

Course Contents:		**Hrs.**
Unit 1	Introduction to Kho-Kho – Aim – Objectives – Short reference in Kho-Kho history Understand the basic rules and how they should play normal game.	**04**
Unit 2	Demonstrate basic skills associated with Kho-Kho, including Fundamental Skills. Chasing Skills- a)Giving Kho b) Taking Direction c) Sudden Change d) Tapping	**06**
Unit 3	Demonstrate basic skills associated with Kho-Kho, including Fundamental Skills. Chasing Skills-e)Turning Round the Post f) Trapping g) Diving h) Fake Kho i) Late kho & Practice.	**05**
Unit 4	Demonstrate basic skills associated with Kho-Kho, including Running Skills a)Position on the court b) Avoiding Trapping c) Positioning near post d) Dodging	**05**
Unit 5	Demonstrate basic skills associated with Kho-Kho, including Running Skills e)Front Dodge f) Back Dodge c) Round the post dodge & Practice	**06**
Unit 6	Kho-Kho Skills Practice & Matches.	**04**

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Course Details:

Class	F.Y. B.Tech: Semester-II
Course Code and Course Title	**2MEHS119_C, Basket Ball**
Prerequisite/s	---
Teaching Scheme: Lecture/Tutorial/Practical	00 / 00 / 02
Credits	01
Evaluation Scheme: ISE/ESE	50 / 00

Course Outcomes: Upon successful completion of this course, the student will be able to:	
2MEHS119_C1	**Introduce** students to the basic skills and knowledge associated with basketball.
2MEHS119_C2	**By** applying these principles through active participation, students develop the necessary skills and knowledge to play basketball.
2MEHS119_C3	**Provides** students with opportunities to improve physical fitness, acquire knowledge of fitness concepts and practice positive personal and social skills
2MEHS119_C4	Students will gain an understanding of how a wellness lifestyle affects one's health, fitness and physical performance.

Course Contents:		**Hrs.**
Unit 1	Introduction & Understand basic basketball rules, terminology, and safety concerns.	**04**
Unit 2	Demonstrate the six basic basketball skills of a) Running b) Jumping c) Passing d) catching e) Dribbling and f) Shooting.	**06**
Unit 3	Demonstrate the ability to perform individual offensive and defensive skills and strategies.	**05**
Unit 4	Understand and apply the knowledge of basic rules of basketball. Skills Practice.	**05**
Unit 5	Demonstrate proper etiquette and good sportsmanship. Successfully participates in skill improvement and offensive game strategies.	**06**
Unit 6	Identify and apply injury prevention principles related to aerobic activities. Practice & Matches.	**04**

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Course Details:

Class	F.Y. B.Tech: Semester-II
Course Code and Course Title	**2MEHS119_D, Hand Ball**
Prerequisite/s	---
Teaching Scheme: Lecture/Tutorial/Practical	00 / 00 / 02
Credits	01
Evaluation Scheme: ISE/ESE	50 / 00

Course Outcomes: Upon successful completion of this course, the student will be able to:	
2MEHS119_D1	**The** student has a basic knowledge of the team values of sports games
2MEHS119_D2	**Acquainting** with the characteristics and trends in the development of the discipline.

Course Contents:		**Hrs.**
Unit 1	Introduction & Understand basic Handball rules, terminology, and safety concerns.	**04**
Unit 2	Health and safety rules. Rules for obtaining credit for the course, Reminder of the history, methodology and basic rules of the game, Exercises to improve passing, grips and throws. The game. Reminder of the refereeing rules.	**06**
Unit 3	Improving the technique of passing and grips in a team setting. Individual ways of freeing oneself from the opponent and the organization of positional attacks with their use	**05**
Unit 4	Exercises improving feints and individual defense technique. Everyone's defense system. Principles of individual defense & Practice.	**05**
Unit 5	Improving the technique of passing and grips in a team setting. Individual ways of freeing oneself from the opponent and the organization of positional attacks with their use. The game & Practice.	**06**
Unit 6	Identify and apply injury prevention principles related to aerobic activities. Practice & Matches	**04**

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Course Details:

Class	F.Y. B.Tech: Semester-II
Course Code and Course Title	**2MEHS119_E, Katthak Classical Dance**
Prerequisite/s	---
Teaching Scheme: Lecture/Tutorial/Practical	00 / 00 / 02
Credits	01
Evaluation Scheme: ISE/ESE	50 / 00

Course Outcomes: Upon successful completion of this course, the student will be able to:	
2MEHS119_E1	**Explain** Importance of katthak with respect to Indian culture.
2MEHS119_E2	**Demonstrate** Guruvandana, Tatkar.
2MEHS119_E3	**Compose** Katthak dance with consideration of classical & semi classical music.

Course Contents:		**Hrs.**
Unit 1	Introduction to Classical dance Katthak & its importance.	**01**
Unit 2	Guruvandana & Tatkaar.(teen taal)	**03**
Unit 3	Chakri & Hast-sanchalan	**03**
Unit 4	Tode (Tigida-tigdig-thai)	**03**
Unit 5	Practice sessions.	**02**
Unit 6	Paran & Tihaei	**05**
Unit 7	Classical dance on Song	**05**
Unit 8	Practice sessions.	**08**

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Department of Mechanical Engineering

Course Details:

Class	F.Y. B.Tech: Semester-II
Course Code and Course Title	**2MEHS119_F,Tabla Classical instruments**
Prerequisite/s	---
Teaching Scheme: Lecture/Tutorial/Practical	00 / 00 / 02
Credits	01
Evaluation Scheme: ISE/ESE	50 / 00

Course Outcomes: Upon successful completion of this course, the student will be able to:	
2MEHS119_F1	**Discover** History of table wadan.
2MEHS119_F2	**Demonstration** of different Taal in table wadan.
2MEHS119_F3	**Develop** notation on new music with help of table wadan.

Course Contents:		**Hrs.**
Unit 1	History& Introduction to Tabla Wadan.	**01**
Unit 2	Tabla presentation of Taal. Tritaal/ Dadra/ Zaptaal/ Kerwa/ Bhajni	**05**
Unit 3	Practice sessions.	**06**
Unit 4	Practice with notation ,& Set one song with tabla	**08**
Unit 5	Practice sessions & students presentations.	**10**

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Course Details:

Class	F.Y. B.Tech: Semester-II
Course Code and Course Title	**2MEHS119_G, Western Dance**
Prerequisite/s	---
Teaching Scheme: Lecture/Tutorial/Practical	00 / 00 / 02
Credits	01
Evaluation Scheme: ISE/ESE	50 / 00

Course Outcomes: Upon successful completion of this course, the student will be able to:	
2MEHS119_G1	**Describe** History of Western dance & basic of western dance.
2MEHS119_G2	**Organize** western dance individually as well as group with help of western music.
2MEHS119_G3	**Compose** western dance on songs.

Course Contents:		**Hrs.**
Unit 1	History of Western dance style & information about western dance.	**02**
Unit 2	Basic types of western dance: - worm-up, Hand- legs movements.	**04**
Unit 3	Teaching Basic style (focus on dance / music / movements, how to control body, emotion/feeling of music/ dance.)	**06**
Unit 4	Training western dance with music (original dance form of western, free style dance)	**08**
Unit 5	Dance composition.	**05**
Unit 6	Practice session , & Students Presentation	**05**

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Course Details:

Class	F.Y. B.Tech: Semester-II
Course Code and Course Title	**2MEHS119_H, Yoga**
Prerequisite/s	---
Teaching Scheme: Lecture/Tutorial/Practical	00 / 00 / 02
Credits	01
Evaluation Scheme: ISE/ESE	50 / 00

Course Outcomes: Upon successful completion of this course, the student will be able to:	
2MEHS119_H1	**Discus** importance of Yoga with respect to different forms of exercise.
2MEHS119_H2	**Perform** Different styles of Yoga.

Course Contents:		**Hrs.**
Unit 1	**Introduction** , importance of yoga, Basic exercise, sun salutation, shavasana taught yogic & excises types	**06**
Unit 2	**Omkar** & sleeping position seats (aasan yogic excise type) to teach omkar in a scientific way, to teach mercatasan , makrasan, setubandhan.	**04**
Unit 3	**Opposite** sleeping position. Shalabhasan, chakras an, Bhungasan, Makrasan. Pranayam: - Anulom-Vilom, Bhasarika, Sheetkari, Bhramari, shitali pranayam. Rapid respiration (jaladshwasan)	**05**
Unit 4	**Practice** sessions	**05**
Unit 5	**Seats** in the sitting position: - padmasan, Wajrasan, Wakrasan, Ardh-machindrasana, Urshtrasan.	**04**
Unit 6	**Seats** in Fine Position. (Dandstithi):-Ekpaadvrukrashasan, Veerasan, Patangasan, Trikonasan.	**06**

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An Autonomous Institute

S.Y. B. Tech. Curriculum

MECHANICAL ENGINEERING

SEMESTER III- IV

w.e.f. 2023-24

Department of Mechanical Engineering

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Teaching and Evaluation Scheme

S. Y. B. Tech Semester - III

Course Code	Course Name	Teaching Scheme				THEORY							PRACTICAL						GRAND TOTAL
						ISE		MSE+ ESE			Total	Min	ISE		ESE		Total	Min	
		L	T	P	Credits	Max	Min	MSE	ESE	Min			Max	Min	Max	Min			
2MEPC201	Applied Mathematics-III	3	-	-	3	40	16	30	30	24	100	40	-	-	-	-	-	-	100
2MEPC202	Kinematics of Machines	3	-	-	3	40	16	30	30	24	100	40	-	-	-	-	-	-	100
2MEPC203	Applied Thermodynamics	3	-	-	3	40	16	30	30	24	100	40	-	-	-	-	-	-	100
2MEPC204	Mechanics of Deformable Solids	3	-	-	3	40	16	30	30	24	100	40	-	-	-	-	-	-	100
2MEPC205	Material Science and Metallurgy	2	-	2	3	40	16	30	30	24	100	40	25	10	25	10	50	20	150
2MEPC206	Machine Tools	-	-	2	1	-	-	-	-	-	-	-	25	10	-	-	25	10	25
2MEPC207	Machine Drawing Laboratory	-	-	2	1	-	-	-	-	-	-	-	25	10	25	10	50	20	50
2MEVS208	Python Programming Laboratory	-	-	2	1	-	-	-	-	-	-	-	25	10	-	-	25	10	25
2MEHS209	Universal Human Values	2	-	-	2	50	20	-	-	-	50	20	-	-	-	-	-	-	50
2MEHS210	Environment Studies	2	-	-	2	50	20	-	-	-	50	20	-	-	-	-	-	-	50
2MECC211	Aptitude and Reasoning Part -I	-	-	2	1	-	-	-	-	-	-	-	25	10	-	-	25	10	25
		18	**0**	**10**	**23**														**775**
	Total Contact Hours	**28**																	

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Course details:

Class			SY B Tech, Semester - III
Course Code and Course Title			**2MEPC201, Applied Mathematics-III**
Prerequisite/s			2MEBS102, 2MEBS111
Teaching Scheme: Lecture/Tutorial/Practical			03/00/00
Credits			03
Evaluation Scheme	**T**	**ISE/MSE/ESE**	40/30/30

Course Outcomes: Upon successful completion of this course, the student will be able to:	
2MEPC201_1	Use linear differential equation to solve the problems on oscillations by using analytical method.
2MEPC201_2	**Apply** the concept of Vector calculus to calculate area and volume of given surface.
2MEPC201_3	**Construct** the Fourier Series for the any functions by using Euler's Formulae.
2MEPC201_4	**Solve** the linear differential equation by using laplace transform.
2MEPC201_5	**Evaluate** algebraic and transcendental equations by numerical techniques.
2MEPC201_6	**Make use of** partial differential equations to solve one dimensional Heat and Wave Equation for boundary value problems.

Course Content:		**Hrs.**
Unit 1	**Linear Differential Equations and Its Application** Definitions, Complete solution, Operator D, Rules for finding Complementary function, Inverse operator, Rules for finding the Particular integral, Oscillations of a spring - Free oscillations, Damped Oscillations, Forced oscillations without damping.	**07**
Unit 2	**Vector Calculus** Introduction, Scalar and vector point functions - vector operator del, Del applied to scalar point functions - gradient, directional derivative, Del applied to vector point functions - Divergence and curl, Line integral, Green's theorem in the plane	**07**
Unit 3	**Fourier Series** Introduction, Euler's Formulae, Conditions for a Fourier expansion, Functions having points of discontinuity, Change of interval, Expansion of odd or even periodic functions, Half range series	**06**

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Unit 4	**Laplace Transform** Introduction, Laplace transform of elementary functions. Properties of Laplace Transforms, Transforms of derivatives, Transforms of integrals, Multiplication by t^n, Division by t, Evaluation of integrals by Laplace Transforms. Inverse Laplace transforms - Method of Partial Fractions, convolution Theorem, Applications of Laplace transform to solve linear differential equations	**06**
Unit 5	**Numerical Solution of Algebraic and Transcendental Equations** Numerical Solution of Algebraic &Trancedental Equations by Bisection method, Regular-Falsi Method, Newton-Raphson Method, Secant Method, Muller's method, Multiple roots by Newton's method.	**06**
Unit 6	**Partial Differential Equations and its Application** Introduction –Formation of partial differential equations, linear equation of the first order (Lagrange's equation) , Method of separation of variables, Vibration of a stretched string, one dimensional wave equation (using separation of variables), One dimensional heat flow equation (using separation of variables).	**07**

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Higher Engineering Mathematics	Dr. B. S. Grewal	KhannaPublication	4th	2007
02	Higher Engineering Mathematics.	H. K. Das	S. Chand and company ltd.,	1st	2011
03	Higher Engineering Mathematics.	B.V. Ramana	Tata McGraw Hill Education Pvt., ltd.	1st	2007
04	A text book of Engineering Mathematics	N.P.Bali, Manish Goyal	Laxmi Publication New Delhi	7th	2007

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Reference Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Advanced Engineering Mathematics	Erwin Kreyszig	John Wiley &Sons,Inc.	9th	2007
02	Advanced Engineering Mathematics.	Potter Merle C.	Oxford University Press,	3rd	2005
03	Engineering Mathematics Vol. I & II	ITL Education	Cengage Learning India PrivateLtd.	1st	2015
04	Advanced Engineering Mathematics.	Oneil Peter V	CengageLearing India Pvt. Ltd.	1st	2012

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Course Details:

Class			SY B Tech, Semester - III
Course Code and Course Title			**2MEPC202, Kinematics of Machines**
Prerequisite/s			2MEBS110
Teaching Scheme: Lecture/Tutorial/Practical			03/00/00
Credits			03
Evaluation Scheme	**T**	**ISE/MSE/ESE**	40/30/30

Course Outcomes (COs): After successful completion of this course, the student will be able to:	
2MEPC202_1	**Explain** the terminology associated with different mechanisms, gears, cam using theory of kinematics.
2MEPC202_2	**Compute** different parameters related to power transmitting devices and cam and follower using analytical or graphical approaches.
2MEPC202_3	**Select** the appropriate mechanism, power transmitting and storing devices for a particular application based on its kinematic analysis.
2MEPC202_4	**Analyze** kinematic behaviour of complex mechanisms using velocity and acceleration diagrams and cam profiles.
2MEPC202_5	**Estimate** dimensional parameters of an appropriate mechanism for selected applications using the theory of kinematics.

Course Contents:		**Hrs**
Unit 1	**Basics of Kinematics and Mechanisms** Kinematic link, Types of links, Kinematic pair, Types of constrained motions, Types of Kinematic pairs, Kinematic chain, Types of joints, Mechanism, Machine, Degree of freedom (Mobility), Kutzbach criterion, Grubler's criterion, Inversion, Four bar chain and its inversions, Grashoff's law, Slider crank chain and its inversions, Double slider crank chain and its inversions, pantograph, steering gear mechanisms, Hooke's joint	**06**
Unit 2	**Analysis of Mechanisms** Velocity and Acceleration Analysis in Mechanism: (Graphical analysis- Velocity and acceleration for different mechanisms using relative velocity and acceleration method), Corioli's component of acceleration, Klein's construction for slider crank mechanism, Instantaneous centre method (Up to 6 IC), Kennedy's theorem. Analytical analysis- Approximate analytical method for Velocity and acceleration of the piston.	**08**
Unit 3	**Mechanical Power Transmitting and Storing Devices** 1) Belt Drive- Calculation of power transmitted, Belt tension ratio, Actual tension in a running belt, Centrifugal and initial tension in the belt, Slip and creep of the belt, V Belts, Selection of Belts.	**05**

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	2) Flywheel- Turning moment diagrams, fluctuation of energy, Coefficient of fluctuation of speed, Rimmed flywheel	
Unit 4	**Theory of Gears** Classification of gears, Types of gears, Spur gears - terminology, fundamental law of toothed gearing, involute and cycloidal profile, conjugate action, contact ratio, minimum number of teeth, interference and undercutting. Helical gears: Nomenclatures, centre distance, force analysis.	07
Unit 5	**Theory of Gear Trains** Types of gear trains, simple, compound, reverted, epicyclic gear train, tabular method for finding the speeds of elements in epicyclic gear trains, torques in the epicyclic gear train, differential gearbox.	07
Unit 6	**Kinematics of Cams and Follower** Classification of cams, Classification of followers, Terminologies of cam and follower, Motions of Follower a) Uniform Velocity b) Simple harmonic motion c) Uniform acceleration and retardation d) Cycloidal motions, Displacement diagram of follower, Velocity and acceleration diagram of Follower, Construction of cam profile	06

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Theory of Machines	Ratan S.S	Tata McGraw Hill New Delhi.	3rd	2012
02	Theory of Machines	P.L.Ballany	Khanna Publication, New Delhi	25th	2012
03	Theory of Machines	V.P. Singh	DhanpatRai and Sons	3rd	2012
04	Kinematics & Dynamics of Machines	George Martin	Waveland Press, Inc.	2nd	2002

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Reference Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Theory of Machines	Thomas Bevan	CBS Publishers, New Delhi.	3rd	2005
02	Theory of Machines and Mechanism	Shigley	Oxford International	3rd	2009
03	Theory of mechanism and machines	Sadhu Singh	Pearson	1st	2012
04	Theory of machines and Mechanism	JagdishLal	Metropolitin Book Company	1st	2011
05	Mechanism and Machines	Gosh And Mallik	East West Press	3rd	1998
06	Theory of Machine	Sarkar	Tata McGraw Hill	1st	2002

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Course Details:

Class			S.Y.B. Tech, Semester-III
Course Code and Course Title			**2MEPC203, Applied Thermodynamics**
Prerequisite/s			2MEBS102, 2MEBS106, 2MEBS107
Teaching Scheme: Lecture/Tutorial/Practical			03/00/00
Credits			03
Evaluation Scheme	T	**ISE/MSE/ESE**	40/30/30

Course Outcomes (COs): After successful completion of this course, the student will be able to:	
2MEPC203_1	**Explain** the fundamentals of thermodynamics for a given system using diagrams or plots.
2MEPC203_2	**Apply** the First law of thermodynamics to the given system using mathematical equations (SFEE).
2MEPC203_3	**Determine** the performance of a given system using second law of thermodynamics.
2MEPC203_4	**Evaluate** the properties of pure substance for a given system using steam table / Mollier chart/ mathematical equations.
2MEPC203_5	**Compute** the performance of given gas / steam turbine using P-V-T diagram, velocity diagram /compounding diagram.

Course Contents:		**Hrs.**
Unit 1	**First Law of Thermodynamics** Thermodynamic systems, properties of a system, state and equilibrium, processes and cycles, temperature and the zeroth law of thermodynamics, heat and work transfer, the first law of thermodynamics, limitations of first law of thermodynamics, energy- a property of system, The first law of thermodynamics for a control volume, The steady-flow process; numerical treatment of SFEE processes	**07**
Unit 2	**Second Law of Thermodynamics** Kelvin–Planck statement, Clausius statement, refrigerators, and heat pumps, the equivalence of the two statements, perpetual-motion machines, Clausius theorem, inequality, useful work, dead state, entropy-property of system, Clausius principle of increase of entropy, available energy referred to cycle, law of degradation of energy	**07**
Unit 3	**Properties of Pure Substance** Definition of pure substance, the phase change of pure substances, p-T, p-v-T Surface and the triple point of water, Ideal gas equation of state and van der Waals equation of state, phase rule formation and properties of	**06**

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	steam, quality of steam, Superheated steam & Characteristics of superheated steam, steam calorimeters, h-s chart or Mollier chart, use of steam table and Mollier chart.	
Unit 4	**Impulse turbines** Rankine and modified Rankine cycle, reheat cycle, regenerative heating, principles of operation, classification, impulse and reaction steam turbine, compounding of steam turbines. flow through impulse turbine blades, velocity diagrams, work done, efficiencies, end thrust, blade friction, influence of ratio of blade speed to steam speed on efficiency of single stage turbines.	07
Unit 5	**Reaction turbines** Flow through impulse reaction blades, velocity diagram, degree of reaction, parson's reaction turbine, back pressure, and pass-out turbine, Governing of steam turbines. losses in steam turbinesperformance of steam turbines and different methods of improving performance, function of the diaphragm, glands, and turbine troubles like erosion, corrosion, vibration, fouling.	**06**
Unit 6	**Gas Turbines and Jet Propulsion** Classification, Merits, Constant pressure combustion, Constant volume combustion, methods of improving thermal efficiency of gas turbine, applications and uses, Fuels, Jet propulsion engine, Gas turbine Blade cooling	**06**

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Thermodynamics: An Engineering Approach	Yunus A. Cengel	McGraw Hill	8th	2015
02	Engineering Thermodynamics	P. K. Nag	McGraw Hill	5th	2013
03	Applied Thermodynamics	Onkar Singh	New Age International	3rd	2009
04	Engineering Thermodynamics	M. Achuthan	PHI Learning Pvt. Ltd.	2nd	2009

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Reference Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Fundamentals of Thermodynamics	Richard E. Sonntag, Claus Borgnakke	New Age International	7th	2009
02	Fundamentals of Thermodynamics	Borhnakke, Sonnatag	Wiley Publication	7th	2009
03	Introduction to Thermal System Engineering	M.J. Moran, H.N. Shapiro, B.R. Munson, D.P. Dewitt	Wiley Publication	10th	2013
04	Fundamentals of Engineering Thermodynamics	Michael J. Moran, Howard N. Shapiro, Daisie D. Boettner, Margaret B. Bailey	John Wiley & Sons, Inc.	8th	2014

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Course Details:

Class			S.Y.B. Tech, Semester-III
Course Code and Course Title			**2MEPC204, Mechanics of Deformable Solids**
Prerequisite/s			2MEES112
Teaching Scheme: Lecture/Tutorial/Practical			03/00/00
Credits			03
Evaluation Scheme	**T**	**ISE/MSE/ESE**	40/30/30

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
1MEPC204_1	**Explain** different types of stresses, strains and elastic constants.
1MEPC204_2	**Identify** and apply a particular theoretical method of stress and strain determination for mechanical elements under various loads.
1MEPC204_3	**Determine** the deflection of beams under different loading conditions.
1MEPC204_4	**Apply** different theories to determine safe load on the columns.
1MEPC204_5	**Determine** strain energy absorbed in the body due to external load, torsion and bending.
1MEPC204_6	**Analyze** the beam by drawing shear force and bending moment diagram.

Course Contents:		**Hrs.**
Unit 1	**Stresses and Strain** Stress, strain, normal and shear stresses, complementary shear stress, Factor of safety, Elasticity, Hooke's Law, Modulus of Elasticity, Poisson's ratio, Bulk modulus, Shear modulus, Inter-relationship between elastic constants, stresses in varying sections of normal and composite bars, thermal stresses.	07
Unit 2	**Principal Stresses and Strains (2D)** Normal and shear stresses on any oblique planes, concept of principal planes, derivation for principal stresses and maximum shear stress, positions of principal planes and planes of maximum shear, graphical solutions using Mohr's circle of stresses, Theories of failures, Introduction to 3D stresses.	06
Unit 3	**I) Shear Force and Bending Moment:** Shear force and bending moment diagram for simply supported, cantilever and overhanging beam subjected to point load, inclined load, UDL, UVL and couple. **II) Torsion:** Theory of torsion, assumptions, derivation of torsion equation, Polar modulus, stresses in solid and hollow circular shaft, power transmitted by shaft.	06

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Unit 4	**Stresses in Beams** **I) Bending stresses:** Pure bending of beams, flexural formula, moment of inertia, bending stresses in beams of various commonly used sections such as I, T, C and cut-out sections. **II) Shear stresses:** Shear stress for different cross-section of beams, distribution of shear stress in beams of various commonly used sections.	**07**
Unit 5	**Deflection of Beams** Concept of slope and deflection, Strain curvature and moment curvature relation, Methods for determining deflections, Solution of beam deflection problem by Double integration method. (Simply supported, cantilever subjected to point load, UDL).	**06**
Unit 6	**I) Columns:** Concept of critical load and buckling, derivation of Euler's formula for buckling load with various end conditions, limitations of Euler's formula, Rankine's buckling load, safe load on column. **II) Strain Energy:** Strain energy due to different types of loading, Pure bending (simply supported beam & cantilever), Shear stresses (Direct Shear & Pure Torsion).	07

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Mechanics of Materials	Ferdinand P Beer E.R. Johnston	McGraw Hill Book Company	5th	2009
02	Strength of Materials	Ramamurthum	DhanpatRai and Sons, New Delhi	7th	2011
03	Strength of Materials	Khurmi Gupta	S. Chand Publication.	26th	2011
04	Strength of Materials	P. N. Chandramouli	PHI, New Delhi.	1st	2013

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Advanced Strength of Materials	Den Hartong J P	Dover Publication Inc Mineola.	1st	2002
02	Mechanical Analysis and Design	H. BURR and John Cheatam	PHI, New Delhi.	2nd	1997
03	Machine Design	Robert Norton	Prentice Hall	2nd	2003
04	Strength of materials	B.K.Sarkar	McGraw Hill Pub.	2nd	2007

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Course Details:

Class			S.Y.B. Tech, Sem. - III
Course Code and Course Title			**2MEPC205, Materials Science and Metallurgy**
Prerequisite/s			2MEBS101, 2MEBS110
Teaching Scheme: Lecture/Tutorial/Practical			02/00/02
Credits			03
Evaluation Scheme	**T**	**ISE/MSE/ESE**	40/30/30
	P	**ISE/ESE**	25/25

Course Outcomes (COs): After successful completion of this course, the student will be able to:	
2MEPC205_1	**Explain** classification of various materials according to their properties using equilibrium diagrams and cooling curves.
2MEPC205_2	**Classify** ferrous and non-ferrous materials in engineering applications using their compositions and properties.
2MEPC205_3	**Find** defects in engineering materials using destructive and Non-destructive testing.
2MEPC205_4	**Select** appropriate heat treatment process for metals and alloys using TTT and CCT diagrams.
2MEPC205_5	**Illustrate** fundamentals of powder metallurgy processes for industrial applications through powder manufacturing processes.

Course Contents: Theory		**Hrs**
Unit 1	**Engineering materials and Alloy Systems:** Introduction to Metallic and Non-metallic materials and its classification (metals/alloys), Crystal, Crystal Defects, Cooling curves, Gibbs phase rule, Construction of equilibrium diagrams from cooling curves, Lever arm principles.	**04**
Unit 2	**Ferrous Alloys and Non-Ferrous Alloys:** Detailed compositions, Properties and Applications for alloys. Fe- Fe3C equilibrium diagram, Ferrous alloys- Carbon steels, cast iron, Alloy steels - Free cutting steels, HSLA high carbon low alloy steels, maraging steels. Stainless steels- different types. Tool steels- types. Copper based alloys and aluminum-based alloys.	**04**
Unit 3	**Principles of Heat Treatment:** Transformation of Pearlite into austenite upon heating, Transformation of austenite into Pearlite, Bainite and Martensite on cooling. TTT –Diagram and CCT - Diagrams - significance, Effect of alloying elements on TTT diagram and its Significance. Heat treatment of steels, Annealing and Normalizing.	**05**

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Unit 4	**Heat Treatment Processes:** Hardening (Hardening types), Purposes, Austempering & Martempering, Mechanism of quenching and Quenching media, Hardenability- Grossmans critical diameter method and Jominy end quench test. Tempering, Surface hardening, Carburising, Nitriding, Plasma ion nitriding, Cyaniding, Carbonitriding, Laser Heat Treatment, Electron Beam Hardening, Heat treatment defects and remedies.	**05**
Unit 5	**Material Testing:** Destructive Testing methods: Tensile, Compressive, Impact, Fatigue, Creep, and Hardness. Non- Destructive Testing: Visual inspection, Dye Penetrant, Magnetic, Ultrasonic, Radiography, Eddy Current testing, Near Filed Testing (NFT).	**04**
Unit 6	**Powder Metallurgy:** Advantages, Limitations and Applications of Powder Metallurgy Powder manufacturing types- Mechanical, Physical, Chemical and Electro-Chemical, Mixing/ Blending, Powder rolling and extrusion, Sintering- Types liquid stage and solid stage sintering, High Temperature Sintering, Finishing operations: Sizing, Machining, Infiltration and Impregnation. Powder metallurgy defects and remedies	**04**

Course Content: Laboratory

1. Spark tree analysis of different types of material.
2. Conduct Hardness test of engineering materials by Brinell and Rockwell tester.
3. Determine Impact strength of engineering materials using impact test.
4. Crack detection in metal components using Ultrasonic testing.
5. Surface damage analysis using dye-penetration test.
6. Examination of microstructure of different types of steel and Cast Iron
7. Examination of microstructure of different types of Aluminum and copper
8. Hardenability testing by Jominy end quench test
9. Tensile test for measurement of mechanical properties
10. Industrial visit

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Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Material science and metallurgy for engineers	V.D. Kodgire	Everest Publishers Pune	12th	2009
02	Introduction to physical metallurgy	S.H.Avner	McGraw Hill Book Company Inc	2nd	1988
03	Engineering Metallurgy Part-I	R. A. Higgins	ELBS with Edward Arnold	6th	1994
04	Material Science and Engineering	V Raghwan	Prentice Hall of India Pvt. Ltd., New Delhi	3rd	1995

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Materials Science & Engineering	W. Callister	John Wiley & sons	2nd	Reprint 2017
02	Heat Treatments Principles and Practices	T.V. Rajan / C.P. Sharma	Prentice Hall of India Pvt Ltd, New Delhi	4th	1994
03	Callister's Materials Science and Engineering	R. Balasubramaniam	Wiley India Pvt Ltd	3rd	2008
04	Mechanical Behaviour and Testing of Materials	K. Bhargava	Publication PHI	2nd	2011

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Course Details:

Class			S.Y.B. Tech, Semester-III
Course Code and Course Title			**2MEPC206, Machine Tools**
Prerequisite/s			2MEPC108, 2MEPC117
Teaching Scheme: Lecture/Tutorial/Practical			00/00/02
Credits			01
Evaluation Scheme	**P**	**ISE / ESE**	25/00

Course Outcomes (COs): After successful completion of this course, the student will be able to:	
2MEPC206_1	**Plan** the sequence of machining operations and prepare process sheet to manufacture a given component by using machining time calculations.
2MEPC206_2	**Execute** various machining operations to produce a component using given production drawing on Lathe machine.
2MEPC206_3	**Use** grinding and shaping operations to produce required features using surface grinder and shaping machine.
2MEPC206_4	**Implement** drilling and milling operations to produce required features using surface drilling and milling machine.
2MEPC206_5	**Select** the machine tool to manufacture the given component using various operations performed on machine tools.

Course Contents: Theory		**Hrs.**
Unit 1	**Lathe Machine**: Introduction, Working principle, types, specifications, parts, accessories, attachments, and various lathe operations.	**03**
Unit 2	**Grinding machines:** Introduction, types of grinding, classification of grinding machines, principle of grinding operations, grinding wheel.	**02**
Unit 3	**Shaping machine:** Crank shaper, hydraulic shaper, table feed mechanism, various operations on shaper, introduction to planer machine.	**02**
Unit 4	**Drilling machine**: Classifications, construction & working of Radial drilling machine, Various operations on drilling machines, introduction to boring machine.	**02**
Unit 5	**Milling machine:** Classification of milling machines, construction and working of column and knee type milling machine, milling operations, study of standard accessories - dividing head, gear cutting on milling machine.	**02**
Unit 6	**CNC Machine:** Introduction to CNC Machine technology, CNC control, CNC Programming.	**02**

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Course Contents for Laboratory:

1. Preparation of Process sheet to produce the job on lathe machine.
2. One job of plain turning, taper tuning, external threading and knurling operation.
3. Hands on Practice on Surface Grinding Machine.
4. Hands on Practice on Shaping Machine.
5. Hands on Practice on Radial Drilling Machine.
6. Hands on Practice on Milling Machine.
7. Hands on Practice on CNC Machine
8. Industrial visit.

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Manufacturing Technology- Foundry, Forming and Welding	P. N. Rao	Tata Mc- Graw Hill Publication	2nd	2009
02	Foundry Technology	O. P. Khanna	DhanpatRai Publication	15th	2011
03	Production Technology: Vol. 1: Manufacturing Processes	P. C. Sharma	S. Chand	1st	2006
04	Production Technology: Vol. 2: Machine Tools	P.C.Sharma	S. Chand	2nd	2006
05	Workshop technology vol.1	S.K.HajraChoudhary S.K.Bose	Media promoters and publishers pvt ltd.	12th	2012
06	Workshop technology vol.2 (Machine tools)	S.K.HajraChoudhary S.K.Bose	Media promoters and publishers pvt ltd.	12th	2012
07	Workshop Technology vol. II,	B.S. Raghuvanshi	DhanpatRai and Sons.	6th	2015

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Reference Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Materials and Processes in Manufacturing	E. Paul DeGarmo, J.T. Black.	PHI Publication	8th	1997
02	Mechanical Metallurgy	George E. Dieter	Tata McGraw Hill Publication	3rd	2013
03	Machine Tools and Manufacturing Technology	Steve F. Krar, Mario Rapisarda.	Delmar publisher	2nd	2010
04	Workshop Technology", Vol. I 2001, Vol. II 2007 and Vol. III 1995.	W.A.J. Chapman	CBS Publishing and Distributors, N. Delhi	5th	2001

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Course Details:

Class			S.Y.B. Tech, Semester-III
Course Code and Course Title			**2MEPC207, Machine Drawing Laboratory**
Prerequisite/s			2MEES106
Teaching Scheme: Lecture/Tutorial/Practical			00/00/02
Credits			01
Evaluation Scheme	P	**ISE/ESE**	25/25

Course Outcomes (COs): After successful completion of this course, the student will be able to:	
2MEPC207_1	**Sketch** of given machine component using empirical relations.
2MEPC207_2	**Apply** the BIS conventions on the drawings of a given component using principles and fundamentals of machines drawing.
2MEPC207_3	**Assign** limits, fits, tolerances and machining symbols on manufacturing/production drawings using principles and fundamentals of geometric dimensioning and Tolerancing.
2MEPC207_4	**Produce** curves of intersections of the surfaces of solids using principles and fundamentals of intersections of solids.
2MEPC207_5	**Prepare** the assembly and detail drawing of a given mechanical engineering components using CAD software.

Course Contents:	
Unit 1	Preparation of sheets on B.I.S. (Bureau of Indian Standards) Conventions for Engineering Materials. Spur, helical and bevel gears. Worm and worm wheel. Rack and pinion. Gear assemblies. Type of helical coil, disc and leaf springs. Internal and external threads. Square thread. Splined shaft, diamond knurling, BIS conventions for sectioning, type of sections. Exceptional cases in sections. BIS methods of linear and angular dimensioning. Symbolic representation of welds as per BIS. conventions.
Unit 2	Preparation of sheets on free hand sketching of machine components like nut, bolts, square and hexagonal nuts, flanged nuts, lock nut, dome nuts, capstan nut, wing nut, castle nut, split pin, square headed bolt, cup headed bolt, T-headed bolt, Rag foundation bolt, stud, washer. Various types of rivets. Various types of keys. Flat pulley, Knuckle joint, Rigid flanged coupling, Solid and bush bearing, Plummer block and applications of above machine components.
Unit 3	Interpenetration of solids - prism with cylinder (Prisms limited up to rectangular base), cylinder with cylinder.
Unit 4	Assembly and details drawing with part list of a assembly containing 6-8 major components.
Unit 5	Preparation of production drawing of a given component using Computer aided drafting.

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Course Contents:

1. Preparation of sheets on B.I.S. (Bureau of Indian Standards) Conventions on A2 size sheet.
2. Preparation of sheets on free hand sketching of machine components on A2 size sheet.
3. Preparation of sheets on interpenetration of solids on A2 size sheet.
4. Computer aided drafting of components and print out of the same on A4 size sheet (minimum eight).
5. Computer aided drafting of details and assembly containing 6-8 major components. Print out of the same on A4 size sheet.
6. Preparation of production drawing of a given component using Computer aided drafting. Print out of the same on A4 size sheet.

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Machine Drawing	R. K. Dhavan,	S. Chand and Company.	1st	2007
02	Machine Drawing.	N. D. Bhatt	Charotor Publication House, Bombay.	5th	2010
03	Production Drawing	Narayana, Kannaiah and Venkatareddy,	New Age International	3rd	2008
04	Machine Drawing	Warren Luzadder	Prentice Hall, India	11th	1999

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Machine Drawing	P.S. Gill	S.K. Kataria and Sons Delhi.	17th	2008
02	Auto cad 2014 for engineers and designers	Sham Tickoo	Dreamtech Publisher	1st	2013
03	Advanced AutoCAD	Robert M. Thomas	Tech Publication.	3rd	1993
04	Exercise workbook for Advanced AutoCAD 2006	Cheryl R. Shrock	New Age International Publication.	1st	2006

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Course Details:

Class			S.Y.B. Tech, Semester-III
Course Code and Course Title			**2MEVS208, Python Programming Laboratory**
Prerequisite/s			2MEVS107, 2MEVS116
Teaching Scheme: Lecture/Tutorial/Practical			00/00/02
Credits			01
Evaluation Scheme	**P**	**ISE/ESE**	25/00

Course Outcomes (COs): After successful completion of this course, the student will be able to:	
2MEVS208_1	**Prepare** programs for given problems without error using python basics, Python's syntax, data types, variables, operators, and basic programming concepts.
2MEVS208_2	**Apply** data structures effectively for storing, manipulating, and retrieving data with the concepts of string, list dictionaries, sets, range and tuples.
2MEVS208_3	**Implement** Python programs for computational problems, using techniques learned in flow control block.
2MEVS208_4	**Design** functions and import modules for repetitive use of sub-program, relating concepts of in-built functions, user defined functions and modules.
2MEVS208_5	**Use** effective debugging skills while resolving common errors with concepts of exception handling.

Course Content:	
Unit 1	**Introduction to Python:** Installation and Working with Python Introduction, why python, Versions of Python, SET PATH, PEP 8 standards , Coding conventions , Understanding Python variables, Identifier rules, Literals, Keywords, IDLE and information, Different ways of execution, Scripting, Python Operators
Unit 2	**Python Data Types** Mutable and Immutable data types, Declaring and using Numeric data types: int, float, complex, Using string data type and string operations, Defining list and list slicing, its methods, Use of Tuple data type
Unit 3	**Python String, Tuple Manipulations** Building blocks of python programs, Understanding string built-in methods, String manipulation using built-in methods, Tuple operation,
Unit 4	**Python List, set and Dictionary Manipulations** List manipulation using built-in methods, Set: its methods and manipulation, Dictionary: its methods and manipulation, functions.

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Unit 5	**Python Program with Flow Control blocks** Conditional blocks using 'if', 'else' and 'elif', 'nested if', 'elif' ladder, Simple 'for' loops in Python, 'For' loop using range, string, list and dictionaries, Use of 'while' loops in Python, Loop manipulation using: pass, continue, break , Programming using Python conditional and loops block.
Unit 6	**Introduction to Functions and Object orientated Programming:** Defining and calling functions, Function parameters and return values, Scopes and namespaces, Exception handling, Introduction to Object orientated Programming.

Course Content:

01 **Introduction to Python:**
- Write a program to print "Hello, World!" on the console.
- Perform basic arithmetic operations (addition, subtraction, multiplication, division) using Python.
- Write a program to convert temperature from Celsius to Fahrenheit.

02 **Data Types and Variables:**
- Create variables of different data types (integer, float, string) and perform operations on them.
- Use string manipulation techniques (concatenation, slicing) to modify and display strings.
- Write a program to swap the values of two variables without using a temporary variable.

03 **Data Structures:**
- Create and manipulate string.
- Implement basic operations on string (string alteration) .
- Write a program to find index value of the substring in the given string.

04 **Data Structures:**
- Create and manipulate lists, tuples, and dictionaries.
- Implement basic operations on lists (append, insert, remove, sort) and dictionaries (add, delete, update).

Write a program to find the second-largest number in a list.

05 **Control Structures:**
- Implement conditional statements (if-else) to check and display the largest among three numbers.
- Write a program to find the factorial of a given number using a while loop.
- Implement a for loop to print the Fibonacci series up to a specified limit.

06 **Functions and Modules:**
- Create a function to calculate the area and perimeter of a rectangle.
- Write a program that imports a custom module and uses its functions to perform mathematical operations.

07 **Exception Handling**
- Prepare **a python program to use try, except and final**

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Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Core Python Programming	Rao, R.N.	DreamtechPress,New Delhi	1st	2017
02	Python Object Oriented Programming	Phillips Dusty	Shroff Pub Distrib Pvt Ltd	1st	2010
03	Head First Python	Barry Paul	Shroff Pub Distrib Pvt Ltd	1st	2010
04	Texts in Computational Science and Engineering Programming	Barth,T.J. (Ed.)	Springer Pvt Ltd.,	1st	2016

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	How to Think Like a Computer Scientist Learning with Python	Downey,A.	Dreamtech Press, New Delhi	1st	2015
02	Machine Learning in Data Science Using Python	Rao,R.N.	Dreamtech Press, New Delhi	1st	2022
03	Texts in Computational Science and Engineering Programming for Computation Python	Barth,T.J. (Ed.)	Springer Pvt. Ltd.,	1st	2016
04	Python Programming: A Beginner's Guide To Learn Python From Zero	John Mnemonic	Paul Colbert and Eleanor Webb	1st	2020

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Course Details:

Class			S. Y. B. Tech. Semester-III
Course Code and Course Title			**2MEHS209, Universal Human Values-I**
Prerequisite/s			--
Teaching Scheme: Lecture/Tutorial/Practical			02/00/00
Credits			02
Evaluation Scheme	T	**ISE/MSE/ESE**	50/00/00

Course Outcomes (COs): After successful completion of this course, the student will be able to:	
2MEHS209_1	**Integrate** the process of self-exploration to achieve Harmony in the human being's based on Holistic perspective of value education.
2MEHS209_2	**Understanding** Harmony in human being, family, society and nature /existence, based on methods to fulfill human aspiration.
2MEHS209_3	**Apply** the human values for maintaining the relationships with one self and others using the principals of harmony.
2MEHS209_4	**Adopt** the methods of maintaining harmony with the society, nature, and its existence by utilizing the human order systems.

Course Contents:		**Hrs.**
Unit 1	**Introduction to Value Education** Introduction, Need, 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.	**04**
Unit 2	**Understanding Happiness and Prosperity** Understanding Happiness and Prosperity correctly, Prevailing sources of happiness, Prosperity and its implications Method to fulfil the human aspirations: understanding and living in harmony at various levels.	**04**
Unit 3	**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.	**05**

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Unit 4	**Understanding Harmony in the Family - Harmony in Human-Human Relationship** Understanding 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; Peer Pressure the Concerns and its Resolution the other salient values in relationship.	**06**
Unit 5	**Understanding Harmony in the Society** Understanding the harmony in society: Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals Human order systems and dimensions	**04**
Unit 6	**Understanding Harmony in the Nature and Existence** Understanding the harmony in the Nature, Inter-connectedness and mutual fulfilment among the four orders of nature, recyclability and self-regulation in nature	**03**

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Understanding Human Being, Nature and Existence Comprehensively	UHV Team	UHV	1st	2022
02	A Foundation Course in Human Values and Professional Ethics	R. R. Gaur, R Asthana, G P Bagaria	Excel Books	2nd	2019
03	Teachers' Manual for A Foundation Course in Human Values and Professional Ethics	R. R. Gaur, R Asthana, G P Bagaria	Excel Books	2nd	2019
04	Human Values	A.N Tripathy	New Age International	2nd	2006

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Reference Books:					
Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	A Foundation Course in Human Values and Professional Ethics	R.R. Gaur, R. Sangal, G.P. Bagaria	Excel Books	3rd	2010
02	Indian Ethos and Modern Management: Amalgam of the Best of the Ideas from the East and the West	B.L. Bajpai	New Royal Book	1st	2004
03	Small Is Beautiful	E. FSchumacher.	Hartley & Marks	1st	1999
04	An Introduction to Ethics	William Lilly	Allied	1st	1967

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Course Details:

Class			S. Y. B. Tech. Semester-III
Course Code and Course Title			**2MEHS210, Environmental Studies**
Prerequisite/s			--
Teaching Scheme: Lecture/Tutorial/Practical			02/00/00
Credits			02
Evaluation Scheme	T	**ISE/MSE/ESE**	50/00/00

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
2MEHS210_1	**Comprehend** the concepts and principles of sustainable development and its importance in environmental preservation.
2MEHS210_2	**Explain** ethical and legal responsibility of an engineer and his role in effective implementation of sustainable activities through EIA and EMS in the corporate sector.
2MEHS210_3	**Predict** impact of contemporary issues (Population Explosion, Climate change, Environmental pollution) on the environment.
2MEHS210_4	**Classify** and analyse different types of environmental pollution, understand their causes and effects, and propose control measures.
2MEHS210_5	**Prepare** a technical report highlighting importance of environment in human life by using techniques like survey, case studies, mini project.

Course Contents:		**Hrs.**
Unit 1	**Introduction to Environment and concept of Sustainable development:** Natural and Built Environment, Environmental Education: Definition, Scope, Objectives and importance. Components of the Environment: Atmosphere, Hydrosphere, Lithosphere and Biosphere. Biological Diversity: Introduction, Values of biodiversity, Threats to biodiversity, Conservation of biodiversity. Sustainable development goals, pillars of sustainable development.	**05**
Unit 2	**Energy and Natural Resources** Energy Scenario: Future projections of Energy Demand, Utilization of various Energy Sources, Conventional Energy Sources and Non-Conventional Energy Sources, Urban problems related to energy. Natural Resources: Food, Water, Forest, Geological, Equitable Use of Resources for Sustainable lifestyle. Concept of life cycle analysis, Case studies.	**04**

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Unit 3	**Introduction to global environmental issues, Impact of modernization** Climate change: Global warming, Ozone depletion, Acid Rain etc. Environmental Impact: Impact of Modern agriculture on the Environment, Impact of Mining on the Environment, Impact of Large dams on the Environment. Environmental pollution: Air, Water, Soil, Noise, Marine, classification of pollutants, their causes, effects and control measures. Case studies.	**04**
Unit 4	**Environmental Pollution** Definition: Causes, effects and control measures of: Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Solid waste Management: Causes, effects and control measures of urban and industrial wastes. E waste management. Role of an individual in prevention of pollution.	**05**
Unit 5	**Environmental Management and Legislation** Environmental ethics: Introduction, Ethical responsibility, issues and possible solutions. Environmental Management: Introduction to Environmental Impact Assessment, Environmental Management System: ISO 14001Standard, Environmental Auditing, National and International Environmental protection agencies pertaining to Environmental Protection. Introduction to Environmental Legislation.	**04**
Unit 6	**Cleaner technology:** Consumerism and Waste Products, Green buildings, Green products, Minimization of Hazardous Products, Reuse of Waste, By-products, Rainwater Harvesting, Translocation of trees. Some Success Stories. Role of Information Technology in Environment protection.	**04**

Text Books

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Environmental Studies	AninditaBasak	PEARSON	1st	2017
02	Environmental Studies	N.K Uberoi,	Excel Books Publications New Delhi,	1st	2005.
03	Environmental Studies from crisis to cure	R. Rajagopalan,	Oxford university press,	2nd	2011

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Reference Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Environmental Science: A Global Concern	William Cunningham and Barbara Woodworth Saigo	WCB/McGraw Hill publication	5th	1999
02	Peter. H. Raven, Linda. R. Berg, George. B. Johnson	Environment	McGraw Hill publication	2nd	1998
03	"Adaptive Environmental Management	Catherine Allan & George H. Stanley (Editors),	Springer Publications.	--	2009.
04	Elements of Environmental Science and Engineering	P. Meenakshi	Prentice Hall of India Private Limited, New Delhi	-	2006

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Course Details:

Class			S. Y. B. Tech. Semester-III
Course Code and Course Title			**2MECC211-Aptitude and Reasoning Part-I**
Prerequisite/s			-
Teaching Scheme: Lecture/Tutorial/Practical			00/00/02
Credits			01
Evaluation Scheme	**P**	**ISE/ESE**	25/00

Course Outcomes (COs) : The students will be able to:	
2MECC211_1	**Solve** problems based on Vedic Mathematics, Calendar, Average, Age,
2MECC211_2	**Solve** problems based on Speed Time distance and equations
2MECC211_3	**Solve** problems based on Blood Relations, Directions, Time Rate Work, Pipes and Tanks, Percentage, Profit and Loss
2MECC211_4	**Solve** Problems based on Spot the Error and Jumbled Para

Course Contents:		**Hrs.**
Unit 1	Vedic Mathematics, Calendar	04
Unit 2	Average, Ages	04
Unit 3	Speed Time Distance, Equations	04
Unit 4	Blood Relations, Directions, Time Rate Work, Pipes and Tanks	04
Unit 5	Percentage, Profit and Loss	04
Unit 6	Spot the Error, Jumbled Para	04
	Self-Study Module	02

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	R.S. Agarwal (Quantitative aptitude)	R.S.Agarwal	S Chand	-	2019
02	R.S. Agarwal (Verbal & Non-verbal Reasoning)	R.S.Agarwal	S Chand	-	2010
03	Wren & Martin (Verbal, Grammar)	P.C.Wren	S Chand	-	2017

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Reference Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	APTIPEDIA (Quantitative, Logical, Verbal Aptitude)	Face	Wiley	-	2017
02	Wiley (Quantitative Aptitude)	P.A.Anand	Maestro	-	2015
03	Arun Sharma (Verbal Ability)	Meenakshi Upadhyay	McGraw Hill	-	2020

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ANNASAHEB DANGE COLLEGE OF ENGINEERING AND TECHNOLOGY, ASHTA

(An Autonomous Institute)

Department of Mechanical Engineering

Teaching and Evaluation Scheme

S. Y. B. Tech Semester - IV

Course Code	Course Name	Teaching Scheme				THEORY							PRACTICAL						GRAND TOTAL
						ISE		MSE+ ESE			Total	Min	ISE		ESE		Total	Min	
		L	T	P	Credits	Max	Min	MSE	ESE	Min			Max	Min	Max	Min			
2ME****	Minor Course-I	2	-	-	2	40	16	30	30	24	100	40	-	-	-	-	-	-	100
2MEPC212	Fluid Mechanics	3	-	2	4	40	16	30	30	24	100	40	25	10	25	10	50	20	150
2MEPC213	Machine Design-I	3	-	-	3	40	16	30	30	24	100	40	-	-	-	-	-	-	100
2MEPC214	Manufacturing Processes	2	-	2	3	40	16	30	30	24	100	40	25	10	-	-	25	10	125
2MEPC215	Dynamics of Machines	2	-	2	3	40	16	30	30	24	100	40	25	10	-	-	25	10	125
2MEPC216	CAD Laboratory	-	-	2	1	-	-	-	-	-	-	-	25	10	25	10	50	20	50
2MEVS217	Microcontroller Laboratory	-	-	2	1	-	-	-	-	-	-	-	25	10	-	-	25	10	25
2MEEL218	Innovation/Prototype	-	-	2	1	-	-	-	-	-	-	-	25	10	-	-	25	10	25
2MEHS219	Psychology	2	-	-	2	50	20	-	-	-	50	20	-	-	-	-	-	-	50
2MEHS220	Constitution of India	1	-	-	1	25	10	-	-	-	25	10	-	-	-	-	-	-	25
2MECC221	Aptitude and Reasoning Part -II	-	-	2	1	-	-	-	-	-	-	-	25	10	-	-	25	10	25
		15	**0**	**14**	**22**														**800**
	Total Contact Hours	**29**																	

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Course Details:

Class			S. Y. B. Tech. Semester-IV
Course Code and Course Title			**2MEPC212, Fluid Mechanics**
Prerequisite/s			2MEBS105
Teaching Scheme: Lecture/Tutorial/Practical			03/00/02
Credits			04
Evaluation Scheme	**T**	**ISE/MSE/ESE**	40/30/30
	P	**ISE/ESE**	25/25

Course Outcomes (COs): After successful completion of this course, the student will be able to:	
2MEPC212_1	**Explain** the fluid properties, fluid characteristics and governing equations for a given fluid/fluid system by using principles of fluid flows.
2MEPC212_2	**Identify** the fluids, fluid flows, and flow measuring devices to analyse its behaviour by using fluid mechanics principles.
2MEPC212_3	**Obtain** expressions of fluid flow parameters to understand the consequences of various consideration susing the principles of fluid mechanics.
2MEPC212_4	**Compute** the fluid flow parameters like velocity, discharge, drag, lift, dimensionless parameters etc. for a given application by using the governing equations.
2MEPC212_5	**Apply** empirical formulae to determine the velocity distribution, shear stress distribution, head losses of the flow through pipes by using fluid mechanics principles.

Course Contents: Theory		**Hrs.**
Unit 1	**Fluid Properties and Fluid Statics:** **A) Fluid Properties:** Definition of fluid, Fluid as a continuum, Properties of fluid, Viscosity, Types of fluid, Compressibility, Surface tension, Capillarity and vapour pressure. **B) Fluid Statics:** Pascal's law, Hydrostatic law of pressure. (Only theoretical treatment on part B)	**07**
Unit 2	**Fluid Kinematics:** Eulerian and Langragian approach of fluid flow, Types of flow, Streamline Path line, Streak line, Stream tube, Continuity equation in Cartesian coordinates in three dimensional forms. Velocity and Acceleration of fluid particles.	**06**
Unit 3	**Fluid Dynamics:** Forces acting on fluid, Euler's equation. Bernoulli's equation, Energy correction factor, Venturimeter, Orifice meter, Flow over triangular and rectangular notches, Introduction to CFD.	**07**

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Unit 4	**Laminar Flow and Pipe Flow:** **A) Laminar Flow:** Laminar flow through circular pipes. Laminar flow through parallel plates. **B) Pipe Flow:** Major and Minor Energy losses in pipes, Series and Parallel pipe, Siphon pipes.	07
Unit 5	**Boundary Layer Theory and Dimensional Analysis, Similitude** **A) Boundary Layer Theory:** laminar and turbulent boundary layer, Boundary layer thicknesses, its characteristics, Boundary layer separation, boundary layer control. **B) Dimensional Analysis, Similitude:** Dimensionally homogeneous equations, Buckingham's Pi-theorem, similitude, complete similarity.	07
Unit 6	**Forces on Immersed Bodies:** Lift and Drag, Drag on a flat plate and on aerofoil. Types of drags, Development of lift, Magnus effect, Stalling condition of an aerofoil.	05

Course Content: Laboratory

1. Flow visualization by Heleshaw apparatus
2. Identify the type of flow by using Reynolds's experiment.
3. Verification of Bernoulli's theorem.
4. Determination of coefficient of discharge for given Venturimeter.
5. Determination of coefficient of discharge for given orifice meter.
6. Determination of coefficient of discharge for given rectangular notch.
7. Orifice under steady flow condition to determine hydraulic coefficients.
8. Determination of velocity profile through circular pipes for laminar flow.
9. Determination of coefficient of friction for different pipes.
10. Case study on discharge measurement (Field work)

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Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Fluid Mechanics and Hydraulic Machines	R.K.Rajput	S. Chand Publication	10th	2019
02	Fluid mechanics and hydraulic machines	P. N. Modi, S.M.Seth	Standard Book House	22nd	2019
03	Fluid Mechanics and Hydraulic Machines	S. Ramamrutham	DhanpatRai Publishing Company	8th	2020
04	Fluid Mechanics	K.L.Kumar	S.Chand Publication	5th	2020

Reference Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
01	Fluid Mechanics	V.L.Streeter&E.B .wylie	Tata McGraw- Hill	8th	2017
02	Introduction to fluid Mechanics	Edward J. Shaughnessy	Oxford university press	5th	2018
03	Fluid Mechanics	Y.A.Cengel	McGraw-Hill,	2nd	2009
04	Fluid Mechanics	White	Tata McGraw-Hill, New Delhi	7th	2014
05	Fundamentals of Fluid Mechanics	Munson Young	Wiley India Pvt.Ltd	6th	2013
06	Fluid Mechanics	FoxMcDonald Pritchard	Wiley India Pvt.Ltd	8th	2014

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Course Details:

Class			S. Y. B. Tech. Semester-IV
Course Code and Course Title			**2MEPC213, Machine Design-1**
Prerequisite/s			2MEBS110
Teaching Scheme: Lecture/Tutorial/Practical			03/00/00
Credits			03
Evaluation Scheme	**T**	**ISE/MSE/ESE**	40/30/30

Course Outcomes (COs): After successful completion of this course, the student will be able to:	
2MEPC213_1	**Describe** the functional requirements, terminologies and classification with working principles of various machine elements by knowing its actual use in real practice/applications.
2MEPC213_2	**Select** the engineering material with proper selection criteria for various elements used in machines by referring the IS codes.
2MEPC213_3	**Derive** the expression to determine dimensions of machine elements under static conditions by acquired knowledge of machine element design.
2MEPC213_4	**Design** the various elements of machine on strength of material basis by using design data book or standard catalogues.
2MEPC213_5	**Compute** the design parameters of various elements of machine subjected to fluctuating conditions by referring standard design procedures.

Course Contents: Theory		**Hrs.**
Unit 1	**Fundamentals of Machine Design:** Concept of Machine design, basic procedure of design of machine elements, Types of loads, Factor of safety- its selection & significance, Theories of elastic failures, Review & Selection of various engineering material properties, Factors governing the selection of engineering materials.	**06**
Unit 2	**Mechanics of Machine element & Design for static load:** Load & stress, Fundamental concept of Shear stress-shear strain, stresses due to bending and torsional moment, principal stresses, Eccentric axial loading, Modes of failure, Design of simple machine elements under static loading- Knuckle joint, Turn buckle and Levers. Numerical on each machine element.	**07**
Unit 3	**Design of Threaded and Welded joints:** **a) Threaded joints:** Types of threads, Terminology of threads, Types of threaded joints, Design of bolted joint loaded eccentrically for condition such as 1) Joints in shear 2) Joints subjected to load perpendicular to the axis of bolt. Numerical on each case. **b) Welded joints** – Terms used in weld joints, Types of welded joints and weld material, Strength of transverse and parallel fillet welds, Design of welded joint loaded eccentrically for condition such as 1) Joint loaded in plane of weld 2)Joint subjected to bending moment. Numerical on each case.	**07**

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Unit 4	**Design of Spring:** Functions of spring, Types of springs, its material and applications, Terminology used for helical springs, styles of end, Design of helical compression spring subjected to static loading. Numerical on helical springs.	**06**
Unit 5	**Design of Power screw:** Forms of threads, Terminology of screw threads, Torque requirement, Self-locking and overhauling properties, Efficiency of square threaded, Self-locking screw, Collar friction torque, Design of power screw & nuts, Numerical on power screw applications.	**06**
Unit 6	**Design for fluctuating load:** Stress concentration - causes & remedies, fluctuating stresses, S-N diagram under fatigue load, Endurance limit, Notch sensitivity, Endurance strength-modifying factors, Design for finite and infinite life under reversed stresses, Soderberg and Goodman diagrams, Modified Goodman diagram, Fatigue design for components under combined stresses such as springs, Beams subjected to point loads etc.	**07**

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Design of Machine Elements	V.B. Bhandari	Tata Mc- Graw Hill Publication	3rd	2012
02	Design of Machine Element	J.F. Shigley	Tata Mc-Graw Hill Publication	8th	2010
03	Machine Design	R. K. Jain	Khanna Publication	7th	2004
04	Mechanical Engineering Design	Shigley& C. R. Miscke	Tata Mc- Graw Hill Publication	8th	2010
05	Design of Machine Elements	M. F. Spotts	PearsonsEdu. Inc.	8th	2004
06	Design of Machine Elements	P. Kannaiah	Scitech Publication.	2nd	2008

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Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Machine Design an Integrated Approach	R.L Norton	Pearson Education Publication	2nd	2007
02	Fundamentals of Machine Component Design	J Marshek	Willey Eastern Ltd.	3rd	2011
03	Mechanical Analysis & Design	H. Burr & Cheatam	Prentice Hall Publication.	2nd	1997
04	Machine Design	Hall, Holowenko, Laughlin	Tata Mc-Graw Hill Publication.	1st	2008
05	Standard Handbook of Machine Design	J. Shigley, C. Mischke,	Tata Mc-Graw Hill Publication.	3rd	2004
06	Design data book	V.B. Bhandari	Tata Mc- Graw Hill Publication	1st	2014

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Course Details:

Class			S. Y. B. Tech. Semester-IV
Course Code and Course Title			**2MEPC214, Manufacturing Processes**
Prerequisite/s			2MEPC206
Teaching Scheme: Lecture/Tutorial/Practical			02/00/02
Credits			03
Evaluation Scheme	**T**	**ISE/MSE/ESE**	40/30/30
	P	**ISE/ESE**	25/00

Course Outcomes (COs): After successful completion of this course, the student will be able to:	
2MEPC214_1	**Explain** the working and elements of different casting processes to produce the work using basic principle of various casting process like sand casting, permanent mould casting.
2MEPC214_2	**Interpret** the working of forming and plastic moulding processes to produce different shaped components with method of operation of these processes.
2MEPC214_3	**Differentiate** between various metal joining processes on the basis of working and elements used in joining processes like welding, soldering and brazing, riveted and bolted joints.
2MEPC214_4	**Choose** the modern manufacturing methods to cut metals, glass, plastic by using the basic principle, mechanism and components of non-conventional machining processes.
2MEPC214_5	**Select** the manufacturing process to produce the various components required in industry using the fundamental knowledge of different manufacturing processes.

Course Contents: Theory		**Hrs.**
Unit 1	**Introduction to manufacturing processes** Introduction and classification of manufacturing processes **Fundamentals of Casting** Importance of casting, advantages, disadvantages and limitations of casting, introduction and types of patterns and core boxes, materials used and selection criteria for patterns, pattern allowances Moulding and core processes: Types of sands used in moulding and core making, their properties. Sand moulding types such as Green sand Moulding, shell Moulding, CO2 Moulding, Investment casting. Equipments and tools used for moulding and core making. Components of gating system, functions and importance of runners and risers, solidification control devices: chills, ceramics.	**05**

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Unit 2	**Casting Processes** Introduction to permanent mould casting processes such as Continuous casting, Gravity die casting, pressure die-casting, Centrifugal casting, Vacuum die casting, Squeeze casting, etc. Sand mould casting such as shell mould casting, green sand casting , dry sand casting, lost foam casting investment casing etc. various casting defects. Introduction to Additive manufacturing processes for mould making.	**04**
Unit 3	**Forming Processes** Various metal forming operations, hot and cold working of metals such as forging, rolling, extrusion, wire drawing, sheet metal working, spinning, swaging, thread rolling, metal forming defects etc.	**04**
Unit 4	**Plastic Moulding** Blow moulding, compression moulding, transfer moulding, injection moulding, extrusion, thermoforming, rotational moulding, foam moulding and calendaring etc.	**04**
Unit 5	**Joining Processes** Overview and classification of joining processes, Surface preparation and various joints, Arc Welding- SMAW, TIG, MIG, Resistance welding- Spot, Seam and Projection welding process, Soldering and Brazing, riveted and bolted joints. Introduction to inspection techniques to inspect the welding joints.	**05**
Unit 6	**Nonconventional machining processes** Need of nonconventional machining, Electro-chemical, electro-discharge, ultrasonic, LASER, electron beam, water jet machining. Introduction to Various Software used for different Manufacturing Processes.	**04**

Course Contents: Laboratory

1. Preparation of Pattern for solid casting with allowances.
2. Determination of Grain fineness number of moulding sand.
3. Preparation and testing of standard Specimen for Green Compressive strength.
4. Preparation of green sand mould for mould Hardness testing.
5. Produce one job based on forging operation.
6. Hands on practice on TIG/MIG welding process for different material.
7. Hands on practice on Soldering/Brazing process for material joining.
8. Industrial visit.

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Text Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
01	Manufacturing Technology- Foundry, Forming and Welding	P. N. Rao	Tata Mc- Graw Hill Publication	2nd	2009
02	Foundry Technology	O. P. Khanna	DhanpatRai Publication	15th	2011
03	Production Technology: Vol. 1: Manufacturing Processes	P. C. Sharma	S. Chand	1st	2006
04	Production Technology: Vol. 2: Machine Tools	P.C.Sharma	S. Chand	2nd	2006
05	Workshop technology vol.1	S.K.HajraChoudhary S.K.Bose	Media promoters and publishers pvt ltd.	12th	2012
06	Workshop technology vol.2 (Machine tools)	S.K.HajraChoudhary S.K.Bose	Media promoters and publishers pvt ltd.	12th	2012
07	Workshop Technology vol. II,	B.S. Raghuvanshi	DhanpatRai and Sons.	6th	2015

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Materials and Processes in Manufacturing	E. Paul DeGarmo, J.T. Black.	PHI Publication	8th	1997
02	Mechanical Metallurgy	George E. Dieter	Tata McGraw Hill Publication	3rd	2013
03	Machine Tools and Manufacturing Technology	Steve F. Krar, Mario Rapisarda.	Delmar publisher	2nd	2010
04	Workshop Technology", Vol.I 2001, Vol.II 2007 andVol.III 1995.	W.A.J.Chapman	CBS Publishing and Distributors, N. Delhi	5th	2001

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Course Details:

Class			SY B Tech, Semester - IV
Course Code and Course Title			**2MEPC215, Dynamics of Machines**
Prerequisite/s			2MEPC202
Teaching Scheme: Lecture/Tutorial/Practical			02/00/02
Credits			03
Evaluation Scheme	**T**	**ISE/MSE/ESE**	40/30/30
	P	**ISE/ESE**	25/00

Course Outcomes (COs): After successful completion of this course, the student will be able to	
2MEPC215_1	**Explain** the terminologies of gyroscope, balancing, governors, dynamics of mechanisms and vibration using basic fundamentals.
2MEPC215_2	**Compute** MI of given bodies anddifferent parameters related to gyroscope, balancing, governor, dynamics of mechanisms, vibration using analytical approaches.
2MEPC215_3	**Select** the appropriate balancing technique and damping method to minimize the vibrations for selected applications through dynamic analysis.
2MEPC215_4	**Determine** the unbalanced forces and couples in different mechanical systems through graphical approach.
2MEPC215_5	**Analyze** the dynamic behaviour of a system using the theory of free vibration.

Course Contents: Theory		**Hrs.**
Unit 1	**Gyroscope** Introduction, Angular acceleration, gyroscopic couple, Effect of gyroscopic couple on an aeroplane, naval ship, Stability of four-wheelers, Gyroscope sensors, Gyroscopic stabilization	**05**
Unit 2	**Governor Mechanism** Governors Comparison between governors and flywheel. Types-centrifugal governors, inertia governors. Force analysis - gravity loaded governors-Porter, Spring loaded governors-Hartnell	**04**
Unit 3	**Static and Dynamic force analysis of mechanisms** Static and dynamic force analysis of mechanisms: Velocity and acceleration of slider crank mechanism by analytical method, Inertia force and torque, D'Alemberts's principle, Dynamically equivalent system	**04**
Unit 4	**Balancing of Rotary Masses** Static and dynamic balancing, Balancing of a single rotating mass by a single mass rotating in the same plane, Balancing of a single mass by two masses rotating in different planes, Balancing of several masses rotating in the same plane, Balancing of several masses rotating in different planes	**04**

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Unit 5	**Balancing of Reciprocating Masses** Primary forces, Secondary forces and a couple in reciprocating machines, Balancing of single cylinder, Balancing of Multi-cylinder inline engine, Balancing of radial engines, Direct and Reverse crack methods of Balancing	**05**
Unit 6	**Fundamentals of Vibration and Single DoF** Basic concepts and definitions, vibration measuring parameters-Displacement, free and forced vibrations, equivalent springs, types of damping Single degree of freedom systems: Free vibrations with and without damping (Rectilinear, torsional and transverse), degree of damping, logarithmic decrement	**04**

Course Contents: Laboratory:

01 Determination of MI of a connecting rod using a compound pendulum method.
02 Determination of MI of a given component using bifilar suspension method.
03 Determination of MI of a given component using trifiler suspension method.
04 A numerical analysis of dynamically equivalent system used for connecting rod.
05 Find the gyroscopic effect on the spinning body.
06 Estimation of characteristics for a Hartnell governor.
07 Experiment on balancing of masses rotating in different planes.
08 A graphical analysis of unbalanced primary and secondary forces and a couple of inline reciprocating engine
09 Experiment to determine the theoretical and experimental natural frequency of spring mass system and verify with PYTHON.
10 Find the damping factor of a given system by Logarithmic decrement experimentally and plot a time response using PYTHON.

Text Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
01	Theory of Machines	Ratan S.S	Tata McGraw Hill New Delhi.	3rd	13th reprint 2012
02	Theory of Machines	P.L.Ballany	Khanna Publication, New Delhi	25th	2012
03	Theory of Machines	V.P. Singh	DhanpatRai and Sons	3rd	2012
04	Kinematics & Dynamics of Machines	George Martin	Waveland Press, Inc.	2nd	2002
05	Mechanical Vibrations	V. P. Singh	DhanpatRai and Sons	6th	2017
06	Mechanical Vibrations	G.K.Grover	Nem Chand & Bros, Roorkee, U.K., India	8th	2014

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Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Theory of Machines	Thomas Bevan	CBS Publishers, New Delhi.	3rd	reprint 2005
02	Theory of Machines and Mechanism	Shigley	Oxford International	3rd	2009
03	Theory of mechanism and machines	Sadhu Singh	Pearson	1st	2012
04	Theory of machines and Mechanism	JagdishLal	Metropolitin Book Company	1st	2011
05	Mechanism and Machines	Gosh And Mallik	East West Press	3rd	1998
06	Theory of Machine	Sarkar	Tata McGraw Hill	1st	2002
07	Mechanical Vibrations	SingiresuS.Rao	Pearson Education	6th	2004

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Course Details:

Class			SY B Tech, Semester - IV
Course Code and Course Title			**2MEPC216, CAD Laboratory**
Prerequisite/s			2MEES106
Teaching Scheme: Lecture/Tutorial/Practical			00/00/02
Credits			01
Evaluation Scheme	**P**	**ISE/ESE**	25/25

Course Outcomes (COs): After successful completion of this course, the student will be able to:	
2MEPC216_1	**Draw** 2D drawings as per given drawing utilizing the modelling software interface.
2MEPC216_2	**Prepare** parametric solid models, surface models and simulation incorporating modelling features with the drawing of given components.
2MEPC216_3	**Modify** parametric solid models, surface models and simulation using modification features with the given constraints.
2MEPC216_4	**Prepare** assembly models using assembly features with the desired assembly constraints.
2MEPC216_5	**Apply** drafting technique on 3D model conforming to recognized standards and conventions using concepts of dimensioning, tolerance, and annotation.

Course Contents: Theory	
Unit 1	**Introduction to CAD/CAM/CAE** Introduction to CAD, CAM, CAE, modelling, simulation, analysis and optimization. Different CAD software, file format IGES, STEP, applications. Introduction to Graphical User Interface (GUI) of 3D modelling software, 2D sketching.
Unit 2	**Solid Modelling** Parametric solid modelling – fundamentals, transform the parametric 2-D sketch into a 3D solid, introduction to different commands in 3-D solid modelling, feature operations.
Unit 3	**Assembly Modelling** Introduction to Assembly modelling, defining relationship between various parts of machine, top down approach, bottom up approach, creation of constraints, generation of exploded view.
Unit 4	**2–D Drafting** Introduction to Drafting, Production drawing – Generation of 2-D sketches from solid model and assembly model, Geometric Dimensioning and Tolerance, straightness, perpendicularity, flatness, angularity, roundness, concentricity, cylindricity, run out, profile, true position, parallelism, orientation.

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Unit 5	**Surface Modelling** Introduction to surface modelling, difference between part modelling and surface modelling, various commands in surface modelling, creation of different surfaces.
Unit 6	**Kinematics Simulations** Introduction to DMU Kinematics, defining constraints, simulating motion of different parts of the assembly, velocity and acceleration of assembly parts.

Course Contents: Laboratory

1. Introduction to CAD/CAM/CAE
2. Solid Modelling with drafting - 3 Exercises
3. Assembly with minimum 5 components - 2 Exercises
4. Surface Modelling - 1 Exercises
5. DMU Kinematics - 1 Exercises

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	CAD/CAM	Ibrahim Zeid, R. Sivasubramanian	Tata McGraw Hill Pvt. Ltd.	1st	2008
02	CAD/CAM (Principles & Applications)	P.N.Rao	Tata McGraw Hill Pvt. Ltd.	5th	2012
03	CAD/CAM	KuldeepSareen, ChandandeepGrewal	S.Chand	1st	2009
04	CATIA V6R16/17	ShyamTickoo Deepak Maini.	DreamTech Press.	-	2009

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	CAD/CAM	M.P.Grover, E.W.Zimmer.	Prentice Hall of India Pvt. Ltd.	1st	2007
02	CAD/CAM/CIM	Radhakrishnan, Subramanyam,	New Age Int. Publishers.	3rd	2004, 2008
03	Computer Aided Mechanical Design & Analysis	V. Ramamurti	Tata McGraw Hill Pvt. Ltd.	4th	2000
04	Computer Aided Design	C.S.Krishnamoorthy,S. Rajeev, A.Rajaraman	Narosa Publishing House	2nd	2005
05	CAD/CAM/CAE	N.K. Chougule	Scitech	1st	2009

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Course Details:

Class			SY B Tech, Semester - IV
Course Code and Course Title			**2MEVS217, Microcontroller Laboratory**
Prerequisite/s			2MEVS107, 2MEES104, 2MEVS116, 2MEPC208.
Teaching Scheme: Lecture/Tutorial/Practical			00/00/02
Credits			01
Evaluation Scheme	**P**	**ISE/ESE**	25/00

Course Outcomes (COs): After successful completion of this course, the student will be able to:	
2MEVS217_1	**Explain** the types, working and characteristics of different sensors, actuators and Transducers using microcontrollers and IOT.
2MEVS217_2	**Integrate** different sensors and Actuators to control various parameters using Arduino-UNO board, PIC, STM32 and Raspberry Pi Microcontrollers.
2MEVS217_3	**Illustrate** speed control programme for various applications of motor using STM32 Microcontroller
2MEVS217_4	**Implement** analog value transmission and LDR control system for various industrial applications using PIC Microcontroller.
2MEVS217_5	**Test** mechanical parameters in various mechanical engineering applications using Node MCU.

Course Content: Theory	
Unit 1	**Introduction to Microcontroller:** Microcontroller Basics: Difference between microprocessor and microcontroller, architectural considerations, CPU, memory sub system, I/O sub system, control logic. Architecture of different microcontroller. Memory structure, different registers (SFR's), addressing modes.
Unit 2	**Types of Sensors and Peripherals:** Sensors: Temperature Sensor, Light Sensor, Proximity/range Sensor; Analog to digital converters: ADC Interfacing; Actuators, Displays, Motors, couplers/isolators, relays. Peripherals: Control and Status Registers, Device Driver, Timer Driver.
Unit 3	**Design and Development:** Embedded system development Environment – IDE, types of file generated on cross compilation, disassemble / de-compiler, simulator, emulator and debugging, embedded product development life-cycle, trends in embedded industry.

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Unit 4	**Introduction to Internet of Things (IOT):** Understanding IOT fundamentals, IOT Architecture and protocols, Various Platforms for IOT, Real time Examples of IOT, Overview of IOT components and IoT Communication Technologies, Challenges in IOT.

Course Contents: Laboratory:

1. Introduction to different microcontrollers (Arduino, Node MCU, PIC, STM32)
2. Introduction to different types of sensors for IOT applications
3. Various protocols for communicating in Microcontrollers.
4. Interfacing Ultrasonic sensor using Arduino kit.
5. Interfacing Temperature sensor using Arduino kit to display temperature and humidity.
6. Experiment on speed control of motor using STM 32.
7. LDR interfacing and Analog value transmission control with PIC Microcontroller.
8. Experiment on vibration measurement using wireless vibration sensor with NodeMCU.
9. Control various switches i.e. AC/DC using IOT.
10. Introduction to Raspberry pi and their control system.

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Arduino Programming	Ryan Turner	Nelly B.L. International Consulting Limited	2nd	2020
02	Exploring Arduino: Tools and Techniques for Engineering Wizardry	Jeremy Blum	Wiley	1st	2019
03	Internet of Things (IoT)	Dr KamleshLakhwani	BPB Publications	1st	2020
04	Raspberry Pi For Dummies	Sean McManus	Wiley	3rd	2017

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Reference Books:					
Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Arduino: A Technical Reference	J. M. Hughes	O'Reilly Media	1st	2016
02	The PIC Microcontroller	John Morton	Elsevier Science	3rd	2005
03	Beginning STM32	Warren Gay	Apress	1st	2018
04	Raspberry Pi Cookbook	Simon Monk	O'Reilly	1st	2013

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Course Details:

Class			SY B Tech, Semester - IV
Course Code and Course Title			**2MEEL218, Innovation/Prototype**
Prerequisite/s			--
Teaching Scheme: Lecture/Tutorial/Practical			00/00/02
Credits			01
Evaluation Scheme	**P**	**ISE/ESE**	25/00

Course Outcomes (COs): After successful completion of this course, the student will be able to:	
2MEEL218_1	Apply the product development process and adapt it to meet specific product requirements during new product development/innovations
2MEEL218_2	Identify customer needs, including latent needs, and establish target specifications aligned with market requirements.
2MEEL218_3	Generate and evaluate innovative product concepts using systematic methods such as concept screening, scoring, and testing.

Course Contents:	
Unit 1	**Introduction to Product Innovation and Development** Characteristics of Successful Product Development, Who Designs and Develops Products, Duration and Cost of Product Development, The Challenges of Product Development, The Product Development Process, and Concept Development: The Front-End Process, Adapting the Generic Product Development Process. Product Development Process Flows.
Unit 2	**Identifying Customer Needs and Product Specifications** The Importance of Latent Needs, The Process of Identifying Customer Needs, What Are Specifications? When Are Specifications Established? Establishing Target Specifications.
Unit 3	**Concept Generation and Concept Selection** The Activity of Concept Generation, A Five-Step Method, Concept Screening, Concept Scoring and Concept testing.
Unit 4	**Prototyping and Intellectual Property Rights** Understanding Prototypes, Principles of Prototyping, Prototyping Technologies, Planning for Prototypes, What Is Intellectual Property? Patent application

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Course Contents: Laboratory (Any seven)

1. Discovering User Needs: Customer Survey and Analysis
2. From Idea to Reality: Building a Simple Prototype
3. Ideas in Action: Brainstorming and Concept Sketching
4. Design Demands: Setting Effective Specifications
5. Choosing the Best: Comparing Design Concepts
6. Print Your Imagination: Introduction to 3D Printing
7. Guarding Ideas: Intellectual Property Insights
8. Developing Virtually: Simulating Product Creation
9. Market Insights: Exploring Consumer Preferences
10. Risk Alert: Identifying Design Flaws with FMEA

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Product design and development.	Eppinger, S., & Ulrich, K	McGraw-Hill Higher Education.	5th	2017
02	Engineering Design Process	Yousef Haik	Florida State University	4th	2010
03	Product design and Manufacturing	A.K. Chitale, R. C. Gupta	PHI Publication	4th	2009
04	Engineering Design Process	Yousef Haik, T. M. M. Shahin	Cengage Learning	2nd	2010

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Product Design	Kevin Otto, Kristin Wood	Pearson Education Indian Reprint	--	2004
02	Engineering Design	George E. Dieter, Linda C. Schmidt	McGraw-Hill International	4th	2009
03	Engineering Design: A Project-based Introduction	Clive L. Dym, Patrick Little	John Wiley & Sons	3rd	2009
04	Product Design and Development	Anita Goyal, Karl T Ulrich, Steven D Eppinger	Tata McGraw-Hill Education	4th	2009

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Course Details:

Class			SY B Tech, Semester - IV
Course Code and Course Title			**2MEHS219,Psychology**
Prerequisite/s			--
Teaching Scheme: Lecture/Tutorial/Practical			02/00/00
Credits			02
Evaluation Scheme	T	**ISE/MSE/ESE**	50/00/00

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
2MEHS219_1	Identify types of emotions, domains of emotional intelligence and their effects on individual and group behavior for fostering empathy and positive relationships.
2MEHS219_2	Explain human behaviour, cognition, and emotions by psychological theories in real-life scenarios and contexts.
2MEHS219_3	Discuss effective time management strategies to overcome time-related challenges.
2MEHS219_4	Interpret psychological factors that contribute procrastination to recognize the situational triggers.
2MEHS219_5	Apply the A-B-C model to manage stress for well-being.

Course Contents:		**Hrs.**
Unit 1	**Psychology** –Definition of Psychology, Different fields of Psychology, Introduction and Need of psychology	**2**
Unit 2	**Emotional Intelligence (EI) (Part one)**– Role of Emotions, Types of Emotions, Emotions/ stress and performance	**4**
Unit 3	**Emotional Intelligence (EI) (Part Two)**– Definition of Emotional Intelligence, Key signs of emotional Intelligence, How EI helps students, Marshmallow Experiment, Five domains of Emotional Intelligence	**6**
Unit 4	**Time Management–** Definition of Time Management, Need and importance of Time management for an individual, Effective steps/ strategies of Time Management, Obstacles of Time Management	**4**
Unit 5	**Procrastination** – Definition of Procrastination, Types of Procrastination excuses , How to work on excuses, Why Do People Procrastinate?, Procrastination Cycle, Challenging Your assumptions, techniques to beat Procrastination	**5**
Unit 6	**Stress Management** – Definition of Stress, A-B-C model for Stress, Identifying Stressful Thoughts and identifying cognitive distortions, Restructuring, Behavioural Coping Strategies	**5**

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Text Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Organizational Behaviour- An Evidence-Based Approach	Fred Luthan	McGraw-Hill/Irwin	12th	2011
02	Essentials of Organizational Behaviour	Stephen P. Robbins Timothy A. Judge Katherine E. Breward	Pearson	-	2018
03	Essentials of organizational Behaviour	Stephen P. Robbins	Prentice Hall	7th	2002
04	Understanding and Managing Organizational Behaviour	Jennifer M. George Gareth R. Jones	Pearson	6th	2012
05	Emotional Intelligence at Work A Professional Guide	Dalip Singh	Response Books A division of Sage Publications	3rd	2006

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Course Details:

Class			SY B Tech, Semester - IV
Course Code and Course Title			**2MEHS220, Constitution of India**
Prerequisite/s			--
Teaching Scheme: Lecture/Tutorial/Practical			01/00/00
Credits			01
Evaluation Scheme	T	ISE/MSE/ESE	25/00/00

Course Outcomes (COs): After successful completion of this course, the student will be able to:	
2MEHS220_1	**Explain** the meaning and history of the Indian constitution using acts of 1935 and 1947.
2MEHS220_2	**Illustrate** the features of Indian constitution for pursuance of the solemn resolution using interpretation of Preamble.
2MEHS220_3	**Recognize** morality and social responsibilities of the Indian Citizen through fundamental rights and duties.
2MEHS220_4	**Identify** different laws and regulations for setting out the practical regime using various information acts.
2MEHS220_5	**Distinguish** the functioning of the centre and state government using Indian parliamentary system and legislative system.

Course Contents:		**Hrs.**
Unit 1	**Constitution: Basic Structure** Meaning of the constitution law and constitutionalism, Historical perspective of the constitution of India, Government of India Act of 1935 and Indian Independence Act of 1947.	**02**
Unit 2	**Making of Indian Constitution :** Enforcement of the Constitution, Meaning and importance of Constitution, Making of Indian Constitution – Sources, Salient features of Indian Constitution, Preamble.	**02**
Unit 3	**Fundamental Rights:** Fundamental Rights – Features and characteristics, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies.	**03**
Unit 4	**Fundamental Duties:** Directive Principles-Definition and Meaning, 42nd Constitutional Amendment Act, List and Importance of Fundamental Duties.	**02**

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Unit 5	**Regulation to Information :** Introduction, Right to Information Act: 2005, Information Technology Act 2000, Electronic Governance in India, Secure Electronic Records and Digital Signatures.	**02**
Unit 6	**Government of The Union and States:** President of India – Election and Powers, Prime Minister of India - Election and Powers, Loksabha - Structure, Rajyasabha – Structure, Governor of State, Chief Minister and Council of Ministers in a state.	**02**

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Indian Polity	M.Laxmikanth	McGraw Hill Publications Delhi	7th	2023
02	The Constitution of India	P.M. Bakshi	Lexis Nexis	19th	2023
03	Introduction to the Constitution of India	Durga Das Basu	Lexis Nexis	26th	2022
04	Governance in India	M. Laxmikanth	McGraw Hill Publications Delhi	3rd	2021

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Constitution of India	V.N.Shukla	EBC	14th	2022
02	The Constitutional Law of India,	J.N. Pandey	Allahabad; Central Law Agency	59th	2022
03	Constitution of India	V.N.Tripathi	Premier Publishing Company	9th	2021
04	India's Constitution	M.V.Pylee	S. Chand Publications New Delhi	18th	2020

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Course Details:

Class			SY B Tech, Semester - IV
Course Code and Course Title			**2MECC221, Aptitude and Reasoning Part- II**
Prerequisite/s			--
Teaching Scheme: Lecture/Tutorial/Practical			00/00/02
Credits			01
Evaluation Scheme	**P**	**ISE/ESE**	25/00

Course Outcomes (COs) : The students will be able to:	
2MECC221_1	**Solve** problems based on HCF, LCM, Interest, Clock, Cubes and Puzzles
2MECC221_2	**Solve** problems based on Coding and Decoding, Seating Arrangements and Venn diagrams.
2MECC221_3	**Solve** problems based on Ratio Proportion, Partnership, Allegation, Divisibility and Number Theory
2MECC221_4	**Demonstrate** presentations using concepts delivered on confidence building and time management skills.

Course Contents:		**Hrs.**
Unit 1	HCF LCM, Simple Interest, Compound Interest	**4**
Unit 2	Coding- Decoding, Seating Arrangement Venn Diagrams	**4**
Unit 3	Clocks, Cubes, Puzzles,	**4**
Unit 4	Ratio Proportion, Partnership	**4**
Unit 5	Confidence Building, Time Management	**4**
Unit 6	Allegation, Divisibility and Number Theory	**4**
	Self-Study Module	**6**

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Text Books:					
Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	R.S. Agarwal (Quantitative aptitude)	R.S.Agarwal	S Chand	-	2019
02	R.S. Agarwal (Verbal & Non-verbal Reasoning)	R.S.Agarwal	S Chand	-	2010
03	Wren & Martin (Verbal, Grammar)	P.C.Wren	S Chand	-	2017

Reference Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
01	APTIPEDIA (Quantitative, Logical, Verbal Aptitude)	Face	Wiley	-	2017
02	Wiley (Quantitative Aptitude)	P.A.Anand	Maestro	-	2015
03	Arun Sharma (Verbal Ability)	Meenakshi Upadhyay	McGraw Hill	-	2020

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(An Autonomous Institute)
Department of Mechanical Engineering

Annasaheb Dange College of Engineering and Technology, Ashta

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T.Y. B. Tech.
Curriculum

MECHANICAL ENGINEERING

SEMESTER V- VI

w.e.f. 2024-25

Department of Mechanical Engineering

ANNASAHEB DANGE COLLEGE OF ENGINEERING AND TECHNOLOGY, ASHTA

(An Autonomous Institute)

Department of Mechanical Engineering

T. Y. B. Tech Semester-V

Course Code	Course Name	Teaching Scheme				THEORY							PRACTICAL					GRAND TOTAL
						ISE		MSE+ ESE			Total	Min	ISE	ESE		Total	Min	
		L	T	P	Credits	Max	Min	MSE	ESE	Min				Max	Min			
2MEPC301	Machine Design-II	2	-	2	3	40	16	30	30	24	100	40	25	-	-	25	10	125
2MEPC302	Turbo Machinery	2	-	2	3	40	16	30	30	24	100	40	25	25	10	50	20	150
2MEPC303	Measurement and Metrology	2	-	2	3	40	16	30	30	24	100	40	25	25	10	50	20	150
2MEEL304	In-plant Training/Internship	-	-	-	1	-	-	-	-	-	-	-	25	-	-	25	10	25
2MEHS305	Entrepreneurship	-	-	2	1	-	-	-	-	-	-	-	50	-	-	50	20	50
2MECC306	Aptitude and Reasoning Part -III	-	-	2	1	-	-	-	-	-	-	-	50	-	-	50	20	50
2MEPE3**	Professional Elective-I	3	-	2	4	40	16	30	30	24	100	40	25	-	-	25	10	125
2ME*****	Minor Course - II	3	-	-	3	40	16	30	30	24	100	40	-	-	-	-	-	100
2ILOE3**	Open Elective - I	3	-	-	3	50	20	-	-	-	50	20	-	-	-	-	-	50
		15	**0**	**12**	**22**													**825**
	Total Contact Hours	**27**																

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Professional Elective - I		
Course Code	**Course Name**	**Domain**
2MEPE307	Noise and Vibration	Design
2MEPE308	Machine Tool Design	
2MEPE309	Experimental Stress Analysis	
2MEPE310	I. C. Engines	Thermal
2MEPE311	Steam Engineering	
2MEPE312	Renewable Energy Engineering	
2MEPE313	Foundry and Forming Technology	Manufacturing
2MEPE314	Industrial Management and Operation Research	
2MEPE315	Industrial Engineering	

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Open Elective Courses		
Course Code	**Course Category**	**Course Name**
2ILOE351	Health Care Management	Economics of Health and Education
2ILOE352	Business Marketing	Business to Business Marketing (B2B)
2ILOE353	Intellectual Property Rights	Patent Law for Engineers and Scientists
2ILOE354		Economics of Innovation
2ILOE355	Business Laws	E-Business
2ILOE356	Finance and Accounting	Management Accounting
2ILOE357	Banking and Insurance	Economics of Banking and Finance Markets
2ILOE358	Investment Management	Quantitative Investment Management
2ILOE359	Human Resource Management	Human Resource Development
2ILOE360	Business Management	Advanced Business Decision Support Systems
2ILOE361	Language	Introduction to Japanese Language and Culture - II
2ILOE362		German - I
2ILOE363	Retail and Channel Management	Operations and Supply Chain Management

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Course Details:

Class			T. Y. B. Tech. Sem.-V
Course Code and Course Title			**2MEPC301, Machine Design-II**
Prerequisite/s			2MEPC213
Teaching Scheme: Lecture/Tutorial/Practical			02/00/02
Credits			03
Evaluation Scheme	**T**	**ISE/MSE/ESE**	40/30/30
	P	**ISE/ESE**	25/00

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
2MEPC301_1	**Explain** fundamental principles and terminology related to the design of various types of gears and bearings.
2MEPC301_2	**Derive** the basic equations of strengths to evaluate the durability and load-carrying capacity of gears and bearings.
2MEPC301_3	**Solve** numerical problems related to the design of gears and bearings applying theoretical concepts to practical engineering scenarios.
2MEPC301_4	**Analyze** forces/stresses acting on gear teeth and bearings to ensure proper design and performance.
2MEPC301_5	**Design** gears and bearings considering dynamic load factors and other design considerations for a given application.

Course Contents: Theory		
Unit 1	**Design of Spur Gears** Spur gear terminology, Force analysis, Gear tooth failures, Beam strength and Wear strength equations, Estimation of module based on beam and wear strength, Effective load on gear tooth, Dynamic load considerations, Methods to account for dynamic load (Velocity factor method, Spott's/Buckingham's equation), Gear design for maximum power transmitting capacity, Problem-solving through numerical exercises.	**05 Hrs**
Unit 2	**Design of Helical Gears** Terminology of helical gears, Virtual number of teeth, Tooth Proportions, Force Analysis, Beam strength and Wear strength considerations, Effective load on gear tooth, Problem-solving through numerical exercises.	**04 Hrs**
Unit 3	**Design of Bevel Gears** Introduction and types of bevel gears, Terminology of bevel gears, Force Analysis, Beam strength equation, Wear strength of bevel gears, Effective load on gear tooth, Problem-solving through numerical exercises.	**04 Hrs**
Unit 4	**Design of Worm Gears** Terminology of worm gears, Proportions of worm gears, Force analysis, Friction in worm gears, Strength rating of worm gears, Wear rating of worm	**04 Hrs**

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	gears, Thermal considerations in worm gear design, Problem-solving through numerical exercises.	
Unit 5	**Design of Rolling Contact Bearings** Types of bearings, Selection of bearing type, Static load carrying capacity, Steinbeck's equation, Rating life of bearings, Selection of bearing life, Dynamic load carrying capacity, Equivalent bearing load, Load life relationship, Selection of bearing from manufacturers catalogue, Design for cyclic loads and speeds, Bearing selection with probability of survival other than 90%. Bearing mounting.	**05 Hrs**
Unit 6	**Design of Sliding Contact Bearings** Hydrodynamic and hydrostatic lubrication, Types of sliding contact bearings, Reynolds equation for fluid film lubrication, Raimondi and Boyd method for bearing analysis, Temperature rise considerations, Selection of design parameters, Problem-solving exercises on the design of hydrodynamic journal bearings.	**04 Hrs**

Course Contents: Laboratory

1. Selection of a flat belt drives for a given application using manufacture's catalogue considering the parameters such as power transmission requirements, belt material, tensioning methods, etc.
2. Selection of a V-belt drives for a given application considering factors like horsepower requirements, speed ratios, pulley diameters, etc.
3. Selection of chain drives for a given application considering chain types, pitch selection, sprocket design, lubrication requirements, etc.
4. Design considerations of shafts and keys and couplings.
5. Design of a gearbox for industrial applications.
    - Background of Gearboxes and Historical Development of Gearbox Technology
    - Importance of Multispeed Gearboxes in Industrial Applications
    - Current Trends and Innovations
    - Design Requirements (Load and Speed Requirements, Design Constraints and Assumptions)
    - Conceptual Design (Selection of Gear Types, Gear Ratios and Speed Calculations)
    - Detailed Design
        - Gear Design: Gear Material Selection, Gear Tooth Design, Gear Dimensions and Parameters
        - Shaft Design: Shaft Material Selection, Shaft Dimensioning and Stress Analysis
        - Bearing Selection and Design
        - Housing Design
        - Lubrication System Design
        - Drawings (Manual Sheet/CAD)

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Text Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
01	Design of Machine Elements	V. B. Bhandari	Tata McGraw Hill Publication	Fifth	2020
02	Design of Machine Elements	J.E. Shigely	Tata McGraw Hill Publication	Tenth	2014
03	Machine Design	R. K. Jain	Khanna Publication	Seventh	1999
04	Machine Design	Dr. N. C. Pandya, Dr. C. S. Shah	Charotar Publication	Twenty First	2022

Reference Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
01	Machine Design Integrated approach	Robert L. Norton.	Tata McGraw Hill Publication	Third	2005
02	Fundamentals of Machine Component Design	Robert C. Juvinall, Kurt M. Marshek	John Wiley & Sons	Fifth	2011
03	Machine Design	Dr. Kannaiah	SCITECH Public.	Third	2006
04	Machine Design	Hall, Holowenko, Laughlin	Tata McGraw Hill Public.	Special Indian Edition	2008

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Department of Mechanical Engineering

Course Details:

Class			T.Y. B. Tech, Sem.-V
Course Code and Course Title			**2MEPC302, Turbo Machinery**
Prerequisite/s			2MEPC212
Teaching Scheme: Lecture/Tutorial/Practical			02/00/02
Credits			03
Evaluation	**T**	**ISE / MSE / ESE**	40/30/30
	P	**ISE/ESE**	25/25

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
2MEPC302_1	**Explain** the construction, working and applications of turbines, pumps, air compressors, fans and blowers for a specific condition by using the turbo machinery principles.
2MEPC302_2	**Compute** various design and operational parameters of turbines, pumps, air compressors, fans and blowers by using various equations of turbo machinery.
2MEPC302_3	**Apply** similarity principles to understand the change in performance parameters of turbo machinery and to classify the turbines and pumps.
2MEPC302_4	**Construct** the performance characteristics of turbines, pumps, air compressors, fans and blowers to predict its behavior for different loading condition.
2MEPC302_5	**Select** an appropriate turbo machine for given condition/application by using the basic principles of turbo machinery.

Course Contents: Theory		
Unit 1	**Impulse Water Turbines:** Euler's equation for work done in Rotodynamic Machines, classification of water turbines, Pelton wheel, its construction and working, velocity triangles, Pelton wheel design (bucket dimensions, number of buckets, jet diameter, wheel diameter, jet ratio, speed ratio, number of jets) calculation of efficiency, power, discharge etc. Governing of Pelton wheel.	**05 Hrs**
Unit 2	**Reaction Water Turbines:** Principle of operation, construction and working of Francis and Kaplan Turbine, velocity triangles, draft tube, calculation of various efficiencies, power, discharge, blade angles, runner dimensions etc. Draft tube-types, Cross flow turbine.	**04 Hrs**
Unit 3	**Centrifugal Pumps:** Working principles, Construction, types, various heads, multistage pumps, velocity triangles, cavitation, MPSH and NPSH, calculations of efficiencies, discharge, blade angles, head, power required, impeller dimensions etc Recent advances in pumps (Pump as turbine).	**04 Hrs**

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Unit 4	**Similarity Principles:** Model testing, unit quantities, specific speed of turbine, specific speed of pumps.	**04 Hrs**
Unit 5	**Rotodynamic Air Compressors:** Centrifugal compressor, velocity diagram. Work done, Theory of operation, losses, adiabatic efficiency, Diffuser, Slip factor. Construction and working of Axial flow compressors, Surging, Chocking, Stalling, Recent advances in compressors.	**05 Hrs**
Unit 6	**Fans and blowers** Introduction, Velocity triangles, Parametric calculations (work done, efficiency), Performance curves for fans and blowers, Fan laws.	**04 Hrs**

Course Contents: Laboratory

1. Trial on Pelton Wheel Turbine for plotting main characteristics.
2. Trial on Francis turbine for plotting main characteristics.
3. Trial on Francis turbine for plotting operating characteristics.
4. Trial on Kaplan turbine for plotting main characteristics.
5. Trial on Kaplan turbine for plotting operating characteristics.
6. Trial on centrifugal pump for plotting operating characteristics.
7. Trial on reciprocating pump for plotting operating characteristics.
8. Trial on centrifugal blower to determine the performance.
9. Evaluate the performance of a centrifugal pump by using analysis software
10. Industrial or hydro power plant visit.

Text Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
01	Fluid Mechanics and Hydraulic Machines	Dr. R.K. Bansal	Laxmi Publication	Ninth	2010
02	Fluid Mechanics and Hydraulic Machines	R.K.Rajput	S. Chand Publication	Ninth	2011
03	Thermal Engineering	R.S.Khurmi J. K. Gupta	S. Chand	Fourteenth	2016
04	Thermal Engineering	R.K.Rajput	Laxmi Publications	Seventh	2009

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Reference Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Fluid mechanics and hydraulic machines	Modi and Seth	Standard Book House	Eighth	2011
02	Fluid mechanics including hydraulic machines	Dr. A. K. Jain	Khanna publishers	First	2009
03	Fluid mechanics and hydraulic machines	S. C. Gupta	Pearson	Sixth	2011
04	Fluid mechanics and hydraulic machines	Domkundwar and Domkundwar	Dhanpat Rai and Co.	First	2006
05	Hydraulic Machines	K Subramanya	Tata McGraw-Hill Education	Fifth	2013

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Course Details:

Class			T.Y. B. Tech, Sem.-V
Course Code and Course Title			**2MEPC303, Measurement and Metrology**
Prerequisite/s			2MEPC206, 2MEPC214.
Teaching Scheme: Lecture/Tutorial/Practical			02/00/02
Credits			03
Evaluation	**T**	**ISE / MSE / ESE**	40/30/30
	P	**ISE/ESE**	25/25

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
2MEPC303_1	**Demonstrate** basics of measurements by considering various parameters using measuring devices.
2MEPC303_2	**Select** proper measuring instrument for measuring various parameters of given components.
2MEPC303_3	**Differentiate** various measuring devices according to different parameters using measurement parameters.
2MEPC303_4	**Evaluate** statistical quality control process and predict either the process is within acceptance limit or not by using graphical/Numerical methods
2MEPC303_5	**Design** Go/No-Go gauge for hole and shaft using Hole/Shaft Basis system

Course Contents: Theory		
Unit 1	**Metrology, limits, fits and tolerances:** Importance and need for measurements, line and end measurement, linear measuring instruments errors in measurement, nomenclature in metrology , interchange ability, limits, fit and tolerances, limit gauging, Taylor's principle, design of limit gauges and its numerical	**05 Hrs**
Unit 2	**Comparators and measurement of angles:** Features of comparators, classification of comparators, different comparators like mechanical, optical, electrical, pneumatic comparators and their uses in inspection. Bevel protractor, clinometers, angle decker, angle slip gauges.	**04 Hrs**
Unit 3	**Straightness, flatness and surface finish measurement:** Concept of straightness and flatness, use of straight edge, level beam comparator and auto collimator for testing of flatness of surface plate. Principle of interferometry and application for checking flatness. Surface roughness terminology, specifying roughness on drawings, surface roughness parameters, roughness measurement methods.	**04 Hrs**
Unit 4	**Screw thread metrology and gear measurement:** Errors in screw threads, measurement of forms of thread, pitch measurement, measurement of thread diameter with standard wire, screw thread micrometer, floating carriage micrometer. measurement of spur gears run out checking, pitch measurement, profile checking, backlash checking, tooth thickness measurement, alignment	**05 Hrs**

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	checking, errors in gears, checking of composite errors, profile projector.	
Unit 5	**Statistical Quality control and acceptance sampling:** Concept of Quality, Quality control and quality assurance, Quality Control tools, Normal Distribution curve, different types of control charts (x bar, r, p and c charts), operating characteristic curves, single and double sampling plans.	**04 Hrs**
Unit 6	**Measurement Techniques:** Thermocouples, thermistor, thermometers, pyrometer, calibration of temperature measuring devices. Mechanical tachometers, electrical tachometer, contactless electrical tachometer, Piezo-electric and seismic accelerometer.	**04 Hrs**

Course Contents: Laboratory

1. Measure various parameters using line and end measuring Instruments.
2. Design Go/No-Go gauge for hole and shaft using Hole/Shaft Basis system
3. Demonstration of dial indicator.
4. Measurement of major diameter, minor diameter & effective diameter of screw thread by using floating carriage micrometre.
5. Measurement of gear tooth thickness, height and angle by using optical profile projector.
6. Measurement of angle by using sine bar.
7. Control charts (X bar and R chart, P chart) and its application for given process.
8. Angular speed measurement using stroboscope, photo-electric pick up and magnetic pick up.
9. Measurement of temperature using, thermocouple RTD, thermistors and pyrometers.
10. Measurement of strain using strain gauges.
11. Industrial visit.

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Text Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
1	Metrology	M. Mahajan	Dhanpat Rai Publications,Delhi	Ninth	2010
2	Statistical Quality control	M. Mahajan	Dhanpat Rai Publications,Delhi	Ninth	2008
3	Engg. Metrology	I.C. Gupta	Dhanpat Rai Publications,Delhi	Twentieth	2010
4	Mechanical Measurement and Control	D.S.Kumar	Metropolitan Book Co.Pvt.Ltd,Delhi	Forth	2011

Reference Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
1	Statistical Quality control	R.C. Gupta	Dhanpat Rai Publications, Delhi	Fifteenth	2009
2	Metrology for Engineers	J.F.W. Gayler and C.R. Shotbolt	Cassell, London	Fifth	1990
3	Practical Engineering Metrology	K.W.B. Sharp	Pitman London	First	1973
4	Engg. Metrology	R.K.Jain	Khanna Publisher, Delhi	Twentieth	2012

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Course Details:

Class			T.Y. B. Tech, Sem.-V
Course Code and Course Title			**2MEEL304, In-plant Training/Internship**
Prerequisite/s			--
Teaching Scheme: Lecture/Tutorial/Practical			00/00/00
Credits			01
Evaluation	**T**	**ISE / MSE / ESE**	00/00/00
	P	**ISE/ESE**	25/00

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
2MEEL304_1	**Explain** the knowledge acquired in a given field during industrial training
2MEEL304_2	**Demonstrate** competency in relevant engineering fields through case study
2MEEL304_3	**Apply** the fundamental knowledge of engineering to given industrial problems/task using appropriate techniques, resources and modern engineering tools
2MEEL304_4	**Communicate** effectively, both orally and in writing report related to given field showing engineering & management principles.

Course Contents:

Industrial Training Requirement:

- Duration: Minimum two weeks during the semester break after the fourth semester.
- Completion: Within 15 calendar days before the start of the fifth semester.
- Industry Preference: Students should seek internships in industries related to mechanical engineering to ensure the experience is relevant and beneficial
- The report should demonstrate practical application of course-related knowledge and skills.
- After completion of training, each student has to submit following documents to training in charge:

1. Industry Evaluation Rubric filled by industry
2. Report of the training (Minimum 25 pages contents of the report with Case Study)
3. Completion original Certificate of Training by Industry.
4. Photocopy of Institute application letter to industry.
5. GPS Images and Photos: Each student must give a hard copy of the Internship Glimpse This template consists of two pages dedicated to showcasing the highlights of your

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internship through photographs, ensure that the template is separate from the internship report document

6. Attendance Sheet

Report Submission Guidelines

As part of the internship program, students are required to submit a detailed report documenting their experiences and learning's during the internship.

The following guidelines outline the requirements for the report submission:

Content Requirements:

1. The report should include an introduction that provides an overview of the internship, including the company name, duration, and objectives.
2. Students should describe the tasks and projects they were involved in, detailing the specific roles and responsibilities they undertook.
3. The report should highlight key observations and insights gained from the internship, focusing on industry practices, technologies, and methodologies encountered.
4. Students are encouraged to analyze and discuss any challenges faced during the internship and how they were addressed or overcome.
5. The conclusion should summarize the overall experience, emphasizing the practical skills and knowledge acquired, and reflecting on how the internship has contributed to their professional development.

Formatting and Structure:

1. The report should be well organized, clearly written, and free of grammatical errors.
2. It should include a title page, table of contents, and properly formatted sections and subsections.
3. Any diagrams, charts, or photographs included should be relevant and appropriately labelled.

Evaluation Process:

Individual student must undergo presentation of training content before the evaluation committee constituted by the department. An internal evaluation will be conducted for examining the quality and authenticity of contents of the report. Marks will be awarded after the end of the presentation and submission of report

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Course Details:

Class			T. Y. B. Tech. Sem.-V
Course Code and Course Title			**2MEHS305, Entrepreneurship**
Prerequisite/s			--
Teaching Scheme: Lecture/Tutorial/Practical			00/00/02
Credits			01
Evaluation Scheme	**T**	**ISE/MSE/ESE**	00/00/00
	P	**ISE/ESE**	50/00

Course Objectives:

This course aims to equip engineering students with the knowledge and skills to identify Opportunities, develop innovative solutions, and launch successful engineering-based ventures.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
2MEHS305_1	**Identify** and evaluate potential business opportunities in the engineering domain
2MEHS305_2	**Conduct** market research and analyze the competitive landscape
2MEHS305_3	**Craft** a comprehensive business plan, including financial projections.
2MEHS305_4	**Understand** the fundamentals of marketing, sales, and operations for engineering ventures.
2MEHS305_5	**Pitch** their business ideas to potential investors.
2MEHS305_6	**Grasp** the legal and ethical considerations of starting a business.

Course Contents: Laboratory

1. The Entrepreneurial Ecosystem
2. Idea Identification and Prototyping
3. Testing, Validation and Commercialisation
4. Market Analysis and Competitive Landscape
5. Legal Procedure to setup an Start-up Business
6. Understanding Finance Basics
7. Business Planning and Development
8. Marketing and Sustainability
9. Pitching and Fundraising
10. Start-up Case Studies

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Assessment Activities:

Assessment 1 : Business Plan

Assessment 2 : Peer Review of Business Plan

Assessment 3 : Elevator Pitch Competition

Assessment 4 : "Shark Tank" Simulation

Reference Materials:

- https://www.startupindia.gov.in/content/sih/en/international/go-to-market-guide/indian-startup-ecosystem.html
- https://www.startupindia.gov.in/content/sih/en/learning-and-development_v2.html
- https://onlinecourses.nptel.ac.in/noc24_mg93/preview

Assessment Modes:

Sl. No	Method/ Technique	Course Outcomes						Marks		Weightage
		1	2	3	4	5	6	Max	Min	
1	ISE : BP	☑	☑	☑	☑	☐	☑	10	20	20 %
2	ISE : PR	☑	☑	☑	☑	☐	☑	10		20 %
3	ISE : EPC	☑	☑	☐	☑	☑	☐	10		20 %
4	ISE : STS	☑	☑	☑	☑	☑	☑	20		40 %

- ISE - In-Semester Examination,
- BP - Business Plan, PR - Peer Review of Business Plan
- EPC - Elevator Pitch Competition, STS - "Shark Tank" Simulation

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Department of Mechanical Engineering

Course Details:

Class			T.Y. B. Tech, Sem.-V
Course Code and Course Title			**2MECC306, Aptitude and Reasoning Part -III**
Prerequisite/s			2MECC211, 2MECC221
Teaching Scheme: Lecture/Tutorial/Practical			00/00/02
Credits			01
Evaluation Scheme:	**T**	**ISE/MSE/ESE**	00/00/00
	P	**ISE/ ESE**	50/00

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
2MECC306_1	**Solve** problem based on basic and advance Permutation and Combination
2MECC306_2	**Solve** problem based on Probability, Application of Probability, Cubes, Dices, cube painting and Syllogism
2MECC306_3	**Solve** problem based on Mensuration 3D, Circle & Triangle
2MECC306_4	**Demonstrate** on Resume writing skill, closed, advanced grammar, Synonyms and Antonyms

Course Contents:		
Unit 1	• Basic Permutation and Combination • Advance Permutation and Combination	**04 Hrs.**
Unit 2	• Probability • Application of Probability	**04 Hrs.**
Unit 3	• Cubes, Dices & cube painting • Syllogism	**04 Hrs.**
Unit 4	• Mensuration 3D • Circle & Triangle	**04 Hrs.**
Unit 5	• Resume writing & resume making • Interview Techniques	**04 Hrs.**
Unit 6	• Closed Test & advanced Grammar • Synonyms & Antonyms	**04 Hrs.**

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Text Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Quantitative Aptitude for Competitive Examinations	R.S. Agarwal	S Chand	Revised	2022
02	A Modern Approach to Verbal & Non-Verbal Reasoning	R.S. Agarwal	S Chand	Revised	2024
03	English Grammar And Composition	P C Wren, H Martin	S Chand	Second	2019

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Course Details:

Class			TY B.Tech, Sem.-V
Course Code and Course Title			**2MEPE307, Noise and Vibration**
Domain			**Design**
Prerequisite/s			2MEBS110, 2MEPC202, 2MEPC215
Teaching Scheme: Lecture/Tutorial/Practical			03/00/02
Credits			04
Evaluation Scheme:	**T**	**ISE/MSE/ESE**	40/30/30
	P	**ISE/ ESE**	25/00

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
2MEPE307_1	**Explain** fundamentals of noise, vibration and measuring instruments,
2MEPE307_2	**Determine** natural frequency of mechanical vibrating system/element,
2MEPE307_3	**Analyze** vibratory response of mechanical system/element,
2MEPE307_4	**Analyze** the mechanical system to reduce the vibrations,
2MEPE307_5	**Estimate** the noise and vibration parameters of mechanical system.

Course Contents: Theory		
Unit 1	**Single degree forced vibration: Damped and Undamped** Overview of Single Degree of Freedom Free damped and undamped vibration. Types of excitation, forced excitation, support excitation, excitation due to unbalance in machines, response of systems to above types of harmonic excitations, transmissibility, force transmissibility and motion transmissibility, vibration isolators, commercial isolation materials and shock mounts. Critical speed of shaft.	**07 Hrs**
Unit 2	**Two Degree Free and Forced Vibration** **(1) Undamped free vibrations:** Principal modes and natural frequencies, co-ordinate coupling and principal co-ordinates. **(2) Undamped forced vibrations:** Harmonic excitation, vibration, dampers and absorbers, dynamic vibration absorber, tuned and un-tuned type.	**07 Hrs**
Unit 3	**Torsional Vibration** Natural frequency of free torsional vibrations, effect of inertia of the constraint on torsional, vibrations, free torsional vibrations of a single rotor system, two rotor system and three rotor system. Torsionally equivalent shaft, free torsional vibrations of a geared system.	**06 Hrs**
Unit 4	**Introduction to Multi degrees of Freedom:** Free vibrations of Multi DOF, Equation of motion, System-Flexibility and stiffness influence coefficient, Eigen value and Eigen vectors, Rayleigh's method, Matrix Method, Matrix iteration method, Holzer's method.	**06 Hrs**
Unit 5	**Vibration Measurement and Control** **(1) Vibration Measurement** Instruments for measurement of displacement, velocity, acceleration and	**06 Hrs**

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	frequency of vibration, Accelerometers, Impact hammer, Vibration shaker, Vibration Analyzer, FFT analyzer, Time and frequency domain plot, Signal analysis - Analysis of Vibration Spectrum, Standards related to measurement of vibration, Machine Conditioning and Monitoring, fault diagnosis. (2) **Vibration Control** Introduction to control of vibration, Vibration control methods, Passive and active vibration control, Reduction of excitation at the source, Control of natural frequency.	
Unit 6	**Noise** **(1) Basics of Noise** Basic definitions, human response to sound, Decibel scale, Relation among sound power, Sound intensity and sound pressure level, Octave band analysis, Noise- Effects, Rating and regulation Non auditory and Auditory effects of noise, Noise standards and limits, Ambient emission noise standards in INDIA, Hazardous noise explosion, Day night noise level. **(2) Noise measurement and control** Noise measuring systems and instruments, Sound in enclosures, Sound energy absorption, Sound transmission through barriers, Noise reduction: at source, at path and at receiver. Automotive noise control principles.	**07 Hrs**

Laboratory Contents: Laboratory

1. Determine damping effect on a system under forced vibration with viscous damping.
2. Experiment on free vibration of a coupled pendulum to determine natural frequency.
3. Experiment on free vibration of a double pendulum to determine natural frequency.
4. Determine natural frequency of torsional vibration of two rotor without damping.
5. Determine natural frequency of torsional vibration of three rotor without damping.
6. Measurement of vibration parameters using vibration measuring instruments.
7. Measurement of vibration parameter by FFT analyzer.
8. Condition monitoring and fault diagnose in a rotating system using vibration measuring technique.
9. Determination of natural frequency by Impact hammer test using FFT analyzer.
10. Measurement of noise by using noise measuring instruments.

Take any 8 experiments from above

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Text Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
01	Mechanical Vibrations	Rao S.S.,	Wiley Publishing Co	Forth	1990
02	Mechanical Vibration	Dr. V. P. Singh	S. Chand and Sons, New Delhi.	Fifth	2007
03	Mechanical Vibration	G. K. Grover	Nemchand and Brothers Roorkee	Second	1972
04	Mechanical Vibration and Noise Engineering	A. G. Ambekar	PHI	First	2006
05	Engineering Vibration	Inmann Daniel J	Pearson	Forth	2001
06	Mechanical Vibration	Austin Church	Wiely Eastern	Second	1963
07	Mechanical Vibrations	J.P. Den Hartog	McGrawhill Book Company Inc.	First	1956
08	Fundamentals of Acoustics	Kinsler Lawrence E. & Frey Austin R.	Wiley Eastern Ltd.	Second	1987.

Reference Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
01	Theory of Machines	Thomas Bevan	CBS Publishers, New Delhi.	Third	reprint 2005
02	Theory of Machines and Mechanism	Shigley	Oxford International	Third	2009
03	Theory of Machines and Mechanism	G.S. Rao and R.V. Dukipatti	New Age Int. Publications Ltd. Delhi.	Second	1992
04	Mechanical Vibrations	SingiresuS.Rao	Pearson Education	Sixth	2004
05	Noise and Vibration Control	Leo L. Bernack	Tata Mc- Graw Hill	Second	1956

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Course Details:

Class			T. Y. B. Tech. Semester- V
Course Code and Course Title			**2MEPE308, Machine Tool Design**
Domain			**Design**
Prerequisite/s			2MEPC213, 2MEPC301
Teaching Scheme: Lecture/Tutorial/Practical			03/00/02
Credits			04
Evaluation Scheme	**T**	**ISE/MSE/ESE**	40/30/30
	P	**ISE/ESE**	25/00

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
2MEPE308_1	**Explain** design requirements for a given machine tool element based on fundamental principles of machine tool design.
2ME PE308_2	**Apply** fundamental laws and principles to design specific elements of a machine tool, ensuring they meet the necessary performance requirements.
2ME PE308_3	**Determine** the key parameters involved in the design of a machine tool tailored for a specific metal cutting operation.
2ME PE308_4	**Analyze** stresses in machine tool elements based on loading constraints.
2ME PE308_5	**Design** a given element of machine tool system using basic principles of machine tool design.

Course Contents: Theory		
Unit 1	**General Principle of Machine Tool Design** Classification of machine tools, General principles of machine tool design, Basic motions in machine tools, Parameter defining working motions, Machining time calculations, Design process applied to tools, Machine tool drives, Selection of electrical drive, Hydraulic drives for machine tools, Cutting tool forces and Horse-Power requirements.	**06 Hrs**
Unit 2	**Design of Gearbox for Regulation of Speed and Feed** Speed and feed regulation, Stepped regulation of speed, Laws of stepped regulation, Gear boxes for speed and feed regulations, Gear box design, Preferred structural formulas, Structural diagrams, Kinematic layout/arrangement, Ray diagram and speed chart, Design of a feed box, Step less regulation of speed and feed.	**07 Hrs**
Unit 3	**Design of Machine Tool Structures** Functions of Machine Tool Structures, Design requirements, Materials for structure, Desired material properties, Design criteria for machine tool structures, Design procedure of machine tool structures, Design strategy for machine tool structures, Design for strength and stiffness, Static and dynamic stiffness, Design of beds, columns, bases and tables.	**07 Hrs**

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Unit 4	**Design of Guideways** Functions and design requirements, Types of Guide ways, Guideways geometries, Materials for guideways, Guideways with sliding friction, Design criteria and calculations for slideways, Design of slideways for wear Resistance, Design of slideways for stiffness, Protecting devices for slideways.	**07 Hrs**
Unit 5	**Design of Spindles and Spindle Support** Key functions and design requirements of spindle unit, Spindle materials and desirable properties, Machine tool compliance and its effect on machining accuracy, Design calculations of spindle, Deflection of spindle axis due to bending and compliance of spindle supports, Selection of bearings for machine tool spindles.	**06 Hrs**
Unit 6	**Design of Control Systems for Machine Tools** Introduction, Design requirements, Control systems for changing speed and feed, Control system for executing, forming and auxiliary motions, Automatic control systems, Adaptive control systems, Ergonomic design of control members, Ergonomic considerations applied to the location of displays and control members, Function symbols used on control panels.	**06 Hrs**

Course Contents: Laboratory

Case Study I: Design of Multi-speed Gear Box for a given Machine Tool

- Design requirements
- Preferred numbers and progression ratio
- Selection of spindle speeds
- Structural diagrams and kinematic arrangement
- Ray diagram and speed chart

Case Study II: Lathe Bed Design

- Material selection
- Forces acting on lathe bed
- Design for strength
- Design for stiffness
- Moment of Inertia of Lathe Bed Section
- Problems on lathe bed design

Case Study III: Design of Columns, Bases and Tables

- Design procedure of columns
- Design procedure of bases
- Design procedure of tables
- Problems on design of columns, bases and tables

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Text Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Machine Tool Design	S.K, Basu	Oxford and IBH Publishing.	Fourth	2019
02	Elements of Workshop Technology Vol. II	S.K. Hajra Choudhary	Media Promoters and Publishers, Mumbai.	Fifth	2010
03	Principles of Modern Manufacturing	M. P. Groover	Wiley Publication	Fifth	2014
04	Production Engineering,	P.C. Sharma	S. Chand Publication.	Fourth	2012

Reference Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Design Principles of Metal-Cutting Machine Tools	F. Koenigsberger	CBS Publishers, New Delhi.	First	2013
02	Machine Tool Design	N. K. Mehta	McGraw Hill Publishing	Third	2012
03	Machine tool design	Sen and Bhattacharya,	CBS Publications	Second	2009
04	Fundamentals of Manufacturing Engineering	D. K. Singh	Tata McGraw Hill education Pvt. Ltd	Ninth	2014

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Course Details:

Class			T. Y. B. Tech. Sem.-V
Course Code and Course Title			**2MEPE309, Experimental Stress Analysis**
Domain			**Design**
Prerequisite/s			2MEPC204
Teaching Scheme: Lecture/Tutorial/Practical			03/00/02
Credits			04
Evaluation Scheme	**T**	**ISE/MSE/ESE**	40/30/30
	P	**ISE/ESE**	25/00

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
2MEPE309_1	**Explain** the fundamentals related to experimental stress analysis using theory of stress-strain.
2MEPE309_2	**Determine** stress and strain in mechanical components by using analytical and experimental approaches.
2MEPE309_3	**Select** the appropriate method of stress analysis to solve mechanical engineering problems.
2MEPE309_4	**Apply** the concept of transmission photo elasticity and determine the principle of stress and direction at critical point.
2MEPE309_5	**Use** the principle of three dimensional photo elasticity and estimate the state of stress.

Course Contents: Theory		
Unit 1	**Methods of Stress Analysis** Overview of stress analysis, Stress analysis approach using analytical, numerical and experimental methods, limitations. stress strain field of various problems, beam under the pure bending, Analytical solutions.	**05 Hrs**
Unit 2	**Transmission Photoelasticity- I** Introduction to Transmission Photoelasticity, Ordinary and Extraordinary Ray, Light Ellipse, Passage of Light Through a Crystal Plate, Retardation Plates, Stress-optic Law, Plane Polariscope, Jones Calculus, Circular Polariscope.	**07 Hrs**
Unit 3	**Transmission Photoelasticity - II** Determination of Photoelastic Parameters at an Arbitrary Point, Tardy's Method of Compensation, Calibration of Photo elastic Materials, Fringe Thinning Methodologies, Fringe Ordering in Photoelasticity, Miscellaneous Topics in Transmission Photoelasticity	**07 Hrs**
Unit 4	**Three Dimensional Photo elasticity :** Introduction to 3D Photo elasticity Stress freezing, locking in model materials, slicing technique, shear difference method, Application for complex problem analysis.	**07 Hrs**

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Unit 5	**Photo elasticity coating and brittle coating** Introduction to photo elastic coating, correction factor, Selection of coating material and its thickness, Industrial application of photo elastic coating, Calibration of photo elastic coating, Introduction of brittle coating ,Analysis of brittle coating.	**06 Hrs**
Unit 6	**Strain Measurement using strain gauges** Introduction to the strain gauge, strain sensitivity of the strain gauge, Bridge sensitivity, Rosettes, Strain gauge alloys, Carriers and adhesive, Performance of the strain gauge system, Temperature compensation, Two wire and three wire circuits, Strain gauge selection, Bonding of the strain gauge, soldering, Accounting for Transverse sensitivity, Correction factor for special application, Special gauges.	**07 Hrs**

Course Content: Laboratory

1. Sheet casting and preparation of photo elastic model.
2. Calibration of photo elastic materials and determining the material stress fringe value parameter.
3. Determination of fractional fringe order using transmission polariscope.
4. Separation of stresses by oblique incidence method.
5. Demonstration based on installation of strain gauges as per manufacturer's catalogue.
6. Determination of unknown weight by using load cells.
7. Evaluation of angle of twist and torque in a shaft subjected to torsion using torque transducers.
8. Determination of gauge factor for one arm sensitive and two arm sensitive configuration.

Text-Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
01	Experimental Stress Analysis	J.W. Dally and W.F. Riley	McGraw-Hill	Third	1991
02	Experimental Stress Analysis	L.S. Srinath, M.R. Raghavan, K. Lingaiah, G. Gargesa, B. Pant, and K. Ramachandra	Tata McGraw Hill	Second	1984

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Reference Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Digital Photoelasticity – Advanced Techniques and Applications	K. Ramesh	Springer	Third	2000
02	Springer Handbook of Experimental Solid Mechanics	W.N. Sharpe (Ed.)	Springer	Fou rth	2008

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Course Details:

Class			T.Y. B. Tech, Sem.-V
Course Code and Course Title			**2MEPE310, I. C. Engines**
Domain			**Thermal**
Prerequisite/s			2MEPC203
Teaching Scheme: Lecture/Tutorial/Practical			03/00/02
Credits			04
Evaluation Scheme:	**T**	**ISE /MSE/ESE**	40/30/30
	P	**ISE/ESE**	25/00

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
2MEPE310_1	Explain the fundamentals of internal combustion engine, fuel supply, lubrication and cooling system of given engine by considering different engine cycles.
2MEPE310_2	Compute the Air-fuel ratio of S.I Engine with reference to standard mixture supply ratio for a given carburettor.
2MEPE310_3	Illustrate the combustion of SI and CI engine based on their working principle used for various applications.
2MEPE310_4	Select the internal combustion engine on the basis of pollution and its control devices for different applications
2MEPE310_5	Evaluate the performance parameters of single and multi-cylinder engines under the load and speed conditions for SI and CI engines.

Course Contents:		
Unit 1	**Introduction to I.C. Engines** Introduction, Classification of I. C. Engines, applications, Selection of IC Engine for different applications, Engine specifications. Engine Cycles, Deviation of actual cycles from air standard cycles, Valve timing diagram for high and low speed engine, Port timing diagram.	**05 Hrs**
Unit 2	**Fuel systems for S.I. and C.I. Engines** **Fuel Systems for S.I. Engines:** Engine fuel requirements, complete carburetor, Derivation for calculation of A/F ratio, Calculation of main dimensions of carburetors, Effect of altitude on Air fuel ratio. Electronic Petrol injection system (MPFI) – components such as sensors, ECU etc., merits and demerits. **Fuel Systems for C.I. Engines:** Requirements of injection system, Types of injection systems – Individual pump, Common rail and Distributor systems, Unit injector, Types of fuel nozzles- single hole, multi hole, pintle, and pintaux, Formation of Spray, Atomization and penetration. Electronic diesel injection system	**07 Hrs**

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Unit 3	**Combustion in S. I. & C.I. Engines.** **Combustion in S. I. Engines.** Stages of combustion, Ignition lag, Flame propagation, Factors affecting flame speed, Abnormal combustion, Influence of engine design and operating variables on detonation, Fuel rating, Octane number, Fuel additives, HUCR, Requirements of combustion chambers of S.I. Engines and its types, Flame Structure & Speed: Laminar burning speeds, Flame propagation relations. **Combustion in C.I. Engines** Stages of combustion, Delay period, Factors affecting delay period, Abnormal combustion- Diesel knock, Influence of engine design and operating variables on diesel knock, Comparison of abnormal combustion in S.I. and C.I. Engines, Cetane number, Requirements of combustion chambers for C.I. Engines and its types, Cylinder pressure analysis: Combustion efficiency, Direct-injection engines, Indirect-injection engines.	**08 Hrs**
Unit 4	**Engine lubrication & Cooling System** **Engine lubrication System** Requirement of lubrication system, Types of lubricants and their properties, SAE rating of lubricants, Types of lubrication systems **Engine Cooling System** Necessity of engine cooling, disadvantages of overcooling, Cooling systems and their comparison: Air cooling, Liquid cooling	**05 Hrs**
Unit 5	**Performance Testing of Engines** Performance parameters, I. S. Standard Code10000 (I to XI) to 10004 for testing of engines), Measurement of performance parameters like torque, power, Volumetric Efficiency, Mechanical Efficiency, BSFC, Brake and Indicated Thermal efficiencies. Numerical on Heat Balance Sheet and engine performance, Performance curves. Introduction to Supercharging and Turbo-charging	**07 Hrs**
Unit 6	**Engine Emission and Control** **S.I.** engine emission (HC, CO, NOx) Control methods- Evaporative (ELCD), Thermal, Catalytic converters, C.I. Engines Emission (CO, NOx, Smog, Particulate), Control methods- Chemical, EGR, Standard pollution Norms like EURO, Bharat stage norms, Introduction to alternative fuels for I.C. engines, Introduction to Electric Vehicle. Recent trends in I.C. Engines.	**07 Hrs**

Course Content: Laboratory

1. Dismantling and Assembling of I.C. engines
2. Demonstration of Engine systems: Air, exhaust, Cooling, Lubrication.
3. Demonstration of ignition systems, Starting systems.
4. Demonstration of Carburetor and Petrol injection system.
5. Demonstration of fuel injection system of diesel engine.

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6. Conduct trial on slow speed diesel engine to calculate heat balance sheet.
7. Conduct trial on high-speed petrol engine to calculate performance parameter.
8. Conduct Morse test on four stroke petrol engines.
9. Conduct trial on electrical drive light duty vehicle.
10. Visit to engine manufacturing or maintenance center.

Text Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
01	Internal Combustion Engines	Mathur and Sharma	Dhanpat Rai Publi. Delhi.	First	1994
02	Internal Combustion Engines	V. Ganesan	Tata McGraw Hill Publications	Fourth	2012
03	Internal Combustion Engines	Domkundwar	DhanpatRai and Sons	First	1999
04	Internal Combustion Engines	Ramlingam	SciTech Publi	Second	2008

Reference Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
01	Internal Combustion Engines	J. B. Heywood	McGraw Hill Education	First	Reprint 2017
02	Engg. Fundamentals of the I.C. Engines	W.W. Pulkrabek	Pearson education	First	2003
03	Internal Combustion Engines - Applied Thermosciences	Ferguson Allan T. Kirkpatrick	Wiley-Blackwell	Third	2015
04	Introduction to Internal Combustion Engines	Richard Stone	Palgrave Macmillan	Third	1999
05	Internal Combustion Engine Handbook: Basics, Components, Systems, and Perspectives	Richard Van Basshuysen, Fred Schäfer	SAE International	First	2016

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Course Details:

Class			T. Y. B. Tech. Semester-V
Course Code and Course Title			**2MEPE311, Steam Engineering**
Domain			**Thermal**
Prerequisite/s			2MEPC203,2MEPC212
Teaching Scheme: Lecture/Tutorial/Practical			03/00/02
Credits			04
Evaluation Scheme	**T**	**ISE/MSE/ESE**	40/30/30
	P	**ISE/ESE**	25/00

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
2MEPE311_1	**Explain** the fundamentals of steam for a given steam generating plant by using fundamentals of thermodynamics.
2MEPE311_2	**Determine** the quality, properties of a given steam using steam table / Mollier chart/ mathematical equations / steam calorimeter .
2MEPE311_3	**Select** the suitable pipe and piping accessories for a given steam plant with the help of manufacture's data /manual.
2MEPE311_4	**Compute** analytically or experimentally the performance of a given boiler / chimney using concepts and principles of thermodynamics.

Course Contents: Theory		
Unit 1	**Fundamentals of steam :** Introduction, What is steam, formation of steam at constant pressure/ temperature, T-v, P-v, T-s and h-s diagram, Steam pressure/temperature relationship, Steam pressure volume relationship, super heated steam, steam as a carrier of heat for process heating, steam distribution pressures, steam quality, heat transfer, flash steam. Properties of steam, Use of steam table/Mollier Chart.	**07 Hrs**
Unit 2	**Steam generation:** Classification of boilers, Boiler Water Treatment - need, types / methodology , Blow-down , boiler mountings and accessories, efficiency of the chimney, draught losses, types of boiler draught, types of burners, ash precipitator	**07 Hrs**
Unit 3	**Performance of Boilers:** Evaporation, equipment evaporation, Boiler efficiency (direct and indirect method), factors affecting boiler efficiency, boiler trial and heat balance, Introduction to IBR, IBR considerations	**06 Hrs**
Unit 4	**Piping Accessories and Steam distribution :** Piping accessories- Valves (types, selection and characteristics) moisture separators, strainers etc. Steam Distribution- Line sizing, good engineering practices in piping design, water hammer, air venting, insulation etc.	**07 Hrs**
Unit 5	**Steam Recovery system:** Trapping and Trap Monitoring, Types of traps, Principles, operation, applications, need of trap monitoring and methods. Flash steam and	**06 Hrs**

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	Condensate recovery. Flash steam recovery, Condensate Management, Steam operated pumps, Flash vessels, Stalling etc.	
Unit 6	**Energy Conservation and Steam Applications** Steam engineering and energy conservation, unit cost of steam, Steam Audit, Introduction to co-generation. Applications of steam in Process industries like Paper, Textile, Dairy and Hospitality. Safety appliances	**06 Hrs**

Course Content: Laboratory

1. Demonstration of constructional details and working of fire tube and Water tube boilers
2. Demonstration of constructional details and working of boiler mounting and accessories
3. Demonstration of constructional details and working of steam trap, steam valves used in steam line
4. Measurement of dryness fraction of steam using separating & throttling calorimeter
5. Performance evaluation of surface condenser
6. Selection of pipe size for a given steam plant with the help of manufacture's data /manual.
7. Selection of steam pipe accessories like trap, valve for a given application with the help of manufacture's data /manual.
8. Performance testing of a boiler
9. Visit to a steam generating unit

Text Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Boiler Operations	M.P. Murgai and Ramchandra	New Age International Private Limited	--	2018
2	Efficient Use of Steam	Oliver Lyle	Her Majesty`s Stationary Office	--	1974
3	Steam Trapping and Air Venting	W.M. Northcroft, L.G. & Barber	Hutchinson And Company (Publishers) Ltd.)	--	1968
4	Valve Handbook	Philip Skousen	Tata McGraw Hill Education	Second	2004

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Reference Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
1	Boilers for Power and Process	Kumar Rayaprolu	CRC Press	First	2009
2	Boiler Operation Engineering	P. Chattopadhyay	Tata McGraw Hill Education	Second	1995
3	Steam Handbook	Dr. Ian Roberts Phillip Stoor Michael Carr Dr. Rainer Höcker Oliver Seifert	Endress+Hauser Flowtec AG, CH-4153 Reinach/BL	First	2017
4	A Practical guide to steam and condensate engineering	--	ARI-Armaturen GmBH &Co.KG	Fourth	2018

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Course Details:

Class			T. Y. B. Tech. Semester-V
Course Code and Course Title			**2MEPE312, Renewable Energy Engineering**
Domain			**Thermal**
Prerequisite/s			2MEBS110, 2MEBS112
Teaching Scheme: Lecture/Tutorial/Practical			03/00/02
Credits			04
Evaluation Scheme	**T**	**ISE/MSE/ESE**	40/30/30
	P	**ISE/ESE**	25/00

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
2MEPE312_1	**Explain** the basics of renewable energy systems for a given system using knowledge of fundamental science
2MEPE312_2	**Identify** the type of energy conversion system to be used for a given application using fundamentals of renewable energy
2MEPE312_3	**Select** a PV Module/ Solar collectors / thermal energy storage for a given application using basics of solar energy
2MEPE312_4	**Plot** load curves and load duration curves for a given system using basics of energy management.
2MEPE312_5	**Analyze** the methods of energy conservation for a given system like illumination system, boilers, air compressor, Heating, ventilation and air conditioning system (HVAC) using basics of energy principles.

Course contents: Theory		
Unit 1	**Fundamentals of Solar Energy:** Introduction to Renewable Energy Sources, Overview of different renewable energy sources (solar, wind, hydroelectric, biomass, geothermal, etc.), basics of solar energy, Solar radiation, factors influencing solar radiation, solar angles (zenith angle, azimuth angle), Solar declination and solar noon, solar irradiance and insolation, Calculation of solar radiation on horizontal and inclined surfaces Application of solar radiation data in solar energy systems design and planning, Instruments for Solar Radiation Measurements	**07 Hrs**
Unit 2	**Solar Energy Utilization Technologies:** Solar collectors: Flat plate, evacuated tube, cylindrical parabolic, concentrating paraboloid, Working principles and applications of each type. **Thermal Energy Storage:** Types of thermal energy storage (sensible heat, latent heat, thermochemical), Importance of thermal energy storage for increasing the efficiency and reliability of solar thermal systems, Solar Distillation and Solar Pond Electric Power Plants. **Solar Electric Power Generation;-** Principle of Solar Cells, types,	**06 Hrs**

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	Components of a photovoltaic system (PV modules, inverters, charge controllers, batteries), Advantages, Disadvantages, and Applications of Solar Photovoltaic Systems	
Unit 3	**Wind Energy**: Properties of wind, availability of wind energy in India, wind velocity and power from wind, site selection, and Basic components of wind energy conversion system (WECS): Classification of WECS- Horizontal axis- single, double and multi-blade system. Vertical axis- Savonius and Darrieus types, Performance of wind Mills Design considerations in blade design	**07 Hrs**
Unit 4	**Tidal Power**: Tides and waves as energy suppliers and their mechanics; fundamental characteristics of tidal power, Harnessing tidal energy, Single & Double Basin system, advantages, and limitations. **Ocean Thermal Energy Conversion**: Principle of working, OTEC power stations in the world, problems associated With OTE, Open & Closed cycle OTEC system	**05 Hrs**
Unit 5	**Load Curves** Load curves and Load duration curves Performance and operational characteristics of power plants, Peak load, Intermediate load and Base load plants and their characteristics, Input-output characteristics of power plants, Economic division of between Base load plant and peak load plants, Tariff methods	**07 Hrs**
Unit 6	**Energy Conservation, Energy Management & Audit:** Energy economics, energy conservation and its importance, strategy, Energy Conservation Act-2001, principles of energy conservation, principle involved in energy management, types of energy audit, energy audit of illumination system, boilers, air compressor, Heating, ventilation and air conditioning system(HVAC)	**07 Hrs**

Course Content: Laboratory

1. Measure solar radiation using a pyranometer and analyse the data.
2. Calculate the solar declination angle, zenith and azimuth angles for a given location and date.
3. Determine the efficiency of different solar collector
4. Study the correlation of wind speed with the power output of a wind turbine.
5. Study the performance of different wind turbine blade designs by using available literature survey.
6. Demonstrate the principle generation of tidal power and Ocean Thermal Energy Conversion (OTEC).
7. Analyze the load duration curve for a specific region or power plant
8. Industry Visit

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Text Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Solar Energy	Dr. S.P.Sukhatme	Tata McGraw Hill.	Third	2008
2	Non-Conventional Energy Sources	G.D.Rai	Khanna Publishers	Fifth	2011
3	Power Plant Engineering	Domkundwar & Arora	Dhanpatrai and Sons	Fifth	2005
4	Power Plant Engineering	R K Rajput	Laxmi publication	Fourth	2008

Reference Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Energy Technology	S. Rao, Dr. B.B.Parulekar	Khanna Publishers	Third	Reprint 2012
2	Solar energy fundamentals& its Application	Rokosh das Begamudre	Tata McGraw Hill.	First	2000
3	Solar energy-Fundamental& its Application	Prof. H.P.Garg	Tata McGraw Hill.	First	2000
4	Renewable energy Sources & their environmental impact	S.A Abbasai	Prentice hall publication	First	2000
5	Energy Resources	MVR Koteshwara	B.S,Publication	First	2004
6	Fundamentals of renewable energy system	D.Mukherjee S.Chakrabarti	New age international	First	2004
7	Renewable energy Technology	C.Palaniappan	Narosa publication	First	2001
8	Introduction to Non Conventional Energy Resources	Raja,	SciTech Publi	First	2005
9	Power Plant Technology	M.M.El Wakil	Mc Graw Hill, Int edition	Fifth	Reprint 2012

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Course Details:

Class			TY B. Tech, Semester-V
Course Code and Course Title			**2MEPE313, Foundry and Forming Technology**
Domain			**Manufacturing**
Prerequisite/s			2MEPC214
Teaching Scheme: Lecture/Tutorial/Practical			03/00/02
Credits			04
Evaluation Scheme	**T**	**ISE / MSE / ESE**	40/30/30
	P	**ISE/ESE**	25/00

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
2MEPE313_1	**Explain** the working of different casting, forming processes and perform sand testing by using basic principle of these manufacturing processes.
2MEPE313_2	**Estimate** force required for deformation in forming processes with the help of basics and various formulas.
2MEPE313_3	**Design** the various elements of gating system for casting process by applying the basic principles of design for gating system.
2MEPE313_4	**Select** appropriate processing techniques for the given job assignment with the help of principle and working of various processes.

Course Contents:		
Unit 1	**Introduction:** Brief History, Foundry, Comparison of casting technology with other metal processing technologies, merits and limitations, Comparison of casting manufacturing in India with that in other countries, 3-D printing for pattern making.	**05 Hrs**
Unit 2	**Casting Practices:** Fundamental of metal casting, Different Types of casting methods, Melting furnaces-rotary, Pit electric, Tilting and cupola, Metallurgical considerations in casting, elements of gating system, and risers and their design.	**08 Hrs.**
Unit 3	**Solidification of Casting:** Crystallization and development of cast structure, Shrinkage of metals, Nucleation, Growth, Dendritic growth,Eutectic freezing, Peritectic reactions, The structure of castings, Concept of progressive and directional solidification, Chvorinov's equation, heat flow analysis, Composite casting of polymers. (Numerical Treatment)	**07 Hrs**
Unit 4	**Fundamentals of Metal Forming:** Classification of forming processes, mechanism of metal forming,	**05 Hrs**

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	temperature of metal working, hot working, cold working, friction and lubricants.	
Unit 5	**Rolling and Forging Practices** Rolling of metals: Classification, Rolling processes, Defects in rolling. (Numerical Treatment) Forging: Classification of forging processes, forging of plate, forging of circular discs, open die and closed-die forging, forging defects, and powder metallurgy forging. (Numerical Treatment)	**07 Hrs**
Unit 6	**Extrusion and Drawing Practices** Extrusion: Classification, Different extrusion processes. Defects in extrusion. (Numerical Treatment) Wire drawing dies, tube drawing process, analysis of wire, deep drawing and tube drawing (Numerical Treatment). Advanced Metal forming processes: High Energy Rate forming (HERF), Electromagnetic forming, residual stresses, and in-process heat treatment and computer applications in metal forming.	**07 Hrs**

Course Content: Laboratory

1. Determination of compressive of moulding sand on Universal Sand Testing Machine.
2. Determination of the effect of water content, clay content on green permeability of foundry sand.
3. Determination of Core Hardness and Mould Hardness.
4. Demonstration of foundry tools and equipment.
5. Demonstration of forging tools and equipments.
6. Preparation of forged models involving upsetting operations.
7. Preparation of forged models involving bending operations.
8. Case study on any casting/ forming process.
9. Industrial visit.

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Text Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Principles of Metal Casting	Heine Loper& Rosenthal	Tata McGraw Hill	Fifth	2005
02	Foundry Technology	P.Beelay	Tata McGraw Hill	Second	2001
03	Fundamentals of Metal Forming Processes	B.L. Juneja	New Age International Publication	Second	2005
04	Technology of Metal Forming Processes	Sunder Kumar	Eastern Economy Edition	First	2003
05	Manufacturing Technology	P.N.Rao	Tata McGraw Hill	First	2012

Reference Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Principle of Foundry Technology	P. L. Jain	Tata McGraw Hill, India	First	2001
02	Workshop Technology vol 1 & vol 2	HajaraChoudhari	Media Publishers & Promoters	Second	2000
03	Foundry Technology	K.P. Sinha & D.B. Goel	Standard Publishers Distributors, India	First	2002
04	Mechanical Metallurgy	G.E. Dieter	Tata McGraw Hill	Third	2017
05	Forging Practice	G. Kamenshchikov	Peace Publication	First	1964
06	Metal Forming Practice: Processes - Machines - Tools	Heinz Tschätsch	Springer	Sixth	2007

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Course Details:

Class			T. Y. B. Tech. Sem.-V
Course Code and Course Title			**2MEPE314, Industrial Management and Operation Research**
Domain			**Manufacturing**
Prerequisite/s			2MEBS102, 2MEBS111
Teaching Scheme: Lecture/Tutorial			03/00/02
Credits			04
Evaluation Scheme:	**T**	**ISE/ MSE/ ESE**	40/30/30
	P	**ISE/ ESE**	25/00

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
2MEPE314_1	**Explain** the fundamentals in functions of management, EDP, SSI, and industrial safety, to manage industrial operations using principles in management and operation research.
2MEPE314_2	**Apply** the principles in management and operation research to manage industrial operations using appropriate techniques in management and operation research.
2MEPE314_3	**Formulate** the problem to be solved to identify the objectives, constraints, and the scope of the study to find a solution using appropriate OR techniques such as linear programming, simulation, or other optimization methods.
2MEPE314_4	**Solve** various types of problems related with operational management to determine the optimal solution using appropriate techniques.

Course Contents: Theory		
Unit 1	**Functions of Management and Marketing Management,** **Management:** Definition of Management, Management environment. **Planning:** Need, Objectives, Strategy, Policies, Procedures, Steps in Planning. **Organizing**: Process of Organizing importance and principle of organizing, Departmentation, Organizational relationship. **Staffing** : Nature, Purpose, Scope, Human resource management, Policies. **Leading:** Communication process, Barriers, Remedies, Motivation- Importance, Theories, Herzberg's theory, Maslow's theory, McGrager's theory. **Marketing Management:** Marketing Concepts –Objective –Types of markets – Market Segmentation, Market strategy, Market Research, Salesmanship, and Advertising.	**06 Hrs**
Unit 2	**Materials Management, EDP, SSI and Industrial Safety** **Materials Management**: Definition, Scope, advantages of materials management, functions of materials management, Purchase Objectives, 5-R Principles of purchasing, Functions of Purchase department. **EDP:** Concept of an entrepreneur, Entrepreneurship development, Qualities required to become entrepreneurs, **SSI:** Definition, Procedure to start Small Scale Industry. Assistance and incentives offered to SSI, Problems of SSI, Feasibility report writing	**07 Hrs**

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Unit 3	**Introduction to OR and Linear Programming Problems** **Introduction**: History and development of OR, Applications, modeling in OR, OR models and their applications. **Linear Programming Problems:** Formulation of problem, Graphical solution, Simplex procedure for maximization and minimization, Duality concept.	**07 Hrs**
Unit 4	**Assignment Model and Transportation Model** **Assignment Model:** Mathematical statement, Methods to solve balanced and unbalanced assignment problems, Maximization problems, Assignment with restrictions, Traveling salesman problem. **Transportation Model:** Mathematical formulation, methods to obtain initial basic feasible solution (IBFS), NWCR, Least Cost and VAM, Conditions for testing optimality, MODI method for testing optimality solution of balanced and unbalanced problems	**07 Hrs**
Unit 5	**Decision Theory and Sequencing** **Decision Theory:** Introduction, Pay off table, Opportunity loss or regret table, Decisions under uncertainty, Laplace criterion, Maximin or Minimax principle, Maximam or Minimin principle, Hurwicz principle, Decisions under risk–maximum likelihood criteria, Expectation principle, Expected opportunity loss, decision trees. **Sequencing:** Sequencing of n jobs on two machines, n jobs on three machines	**06 Hrs**
Unit 6	**Project Management:** Introduction to PERT and CPM, critical Path calculation, float calculation and its importance. **Replacement theory:** Computation Replacement - need, Replacement of items whose maintenance cost increases with time (with and without considering time value of money), Replacement of items that fail suddenly	**06 Hrs**

Course Content: Laboratory

1. Exercises on management functions (Planning, Organizing, Staffing, and Leading).
2. Case study on motivational theories.
3. Case study on marketing management.
4. Case study on Small Scale Industry.
5. Linear Programming: Graphical Method
6. Linear Programming: Duality concept
7. Linear Programming: Simplex Method
8. Determination of optimal sequence and minimum elapsed time using n-jobs 2/3 machine technique.
9. Development of CPM and PERT network for any project involving minimum seven activities.
10. Demonstration of solving assignment problems using MS Excel Solver.

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Text Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Industrial Management & Operation Research	N.K.Hukeri	Electrotech Publication	Seventh	2016
02	Operations Research	D.S. Hira & P.K. Gupta	S. Chand & Co., New Delhi	Fifth	2011
03	Production and operation management	R.B.Khanna	PHI	Second	2015
04	Operation Research an Introduction	Hamdy A. Taha	Pearson	Tenth	2017

Reference Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Operation Research	G.Shriniwasan	Prentice Hall of India Publication	Second	2003
02	Operation Research	J.K. Sharma	McMillan India Publication, Delhi	Eighth	2011
03	Production and operation management	S.N.Chary	Tata McGraw Hill, New Delhi	Fifth	2015
04	Introduction to Operations Research-Theory & Applications	H.S. Kasana& K.D. Kumar	Springer	First	2008

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Course Details:

Class			T. Y. B. Tech. Semester-V
Course Code and Course Title			**2MEPE315, Industrial Engineering**
Domain			**Manufacturing**
Prerequisite/s			2MEPC205, 2MEPC206, 2MEPC207, 2MEPC214, 2MEPC303,
Teaching Scheme: Lecture/Tutorial/Practical			03/00/02
Credits			04
Evaluation Scheme	**T**	**ISE/MSE/ESE**	40/30/30
	P	**ISE/ESE**	25/00

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
2MEPE315_1	**Explain** the fundamentals of productivity, value engineering, plant layout, and lean manufacturing tools to improve productivity using principles of Industrial Engineering.
2MEPE315_2	**Suggest** the method study and work measurement techniques, capacity and inventory control techniques to record, and time calculation of various industrial tasks, and for industrial capacity and inventory control using appropriate methods and strategies.
2MEPE315_3	**Compute** the productivity, the normal and standard time, allowances, and the optimum sequence and schedule for given production scenario, for various industrial activities and jobs using equations of work measurement, and scheduling.
2MEPE315_4	**Construct** the appropriate charts and diagrams, the project network diagrams to record various industrial tasks and operations, for timely completion of project using appropriate recording techniques and network techniques.

Course Contents: Theory		
Unit 1	**Industrial Engineering and Productivity** Scope, Role of industrial engineer, tools and techniques of industrial engineering, Productivity- concept, objective, factors affecting productivity, tools & techniques to improve productivity, value analysis & value engineering.	**6 Hrs**
Unit 2	**Lean manufacturing** JIT, SMED, 5S, Kaizen, Six Sigma, Kanban, Management Information System, Total productive maintenance, Poka-Yoke.	**7 Hrs**
Unit 3	**Method Study** Objectives of method study, various recording techniques, therblings, micro-motion study, MEMO motion study, principles of motion economy.	**6 Hrs**

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Unit 4	**Work Measurement** Definitions, objectives, activity and elements, performance rating, rating methods, allowances, work sampling, predetermined motion time system, workplace ergonomics.	**7 Hrs**
Unit 5	**Capacity and aggregate planning and scheduling of operations** Introduction, measures of capacity, capacity strategies, overcapacity & under capacity factors. Aggregate planning, Aggregate planning strategies. Sequencing problems, n jobs 1 Machine, n jobs 2 Machines, n jobs 3 Machines.	**6 Hrs**
Unit 6	**Facility Planning, Inventory Control and Network Techniques** Inventory valuation by LIFO and FIFO, ABC analysis, MRP, MRP-II, ERP, network techniques, critical path method, forward & backward scheduling. PERT, Plant layout, Types of plant layout, principle & objective of plant layout, Factors influencing selection.	**7 Hrs**

Course Content: Laboratory

1. Exercises on productivity measurement.
2. Case study on lean manufacturing tools.
3. Exercises on recording techniques for industrial activities.
4. Exercises on recording techniques for industrial activities.
5. Standard time estimation by different methods.
6. Determination of optimal sequence and minimum elapsed time using n-jobs 2/3 machine technique.
7. Development of CPM & PERT Network for any project involving minimum seven activities.
8. Exercises on plant layout preparation.
9. Exercises on assembly line balancing.
10. Industrial visits for data collection and conducting experiments.

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Text Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Hand Book of Industrial Engineering	Gavrial Salvendy	John Wiley and Sons, New York,	--	2007
02	Industrial Engineering	M. I. Khan	New age international(P) Ltd, New Delhi	Reprint	2004
03	Introduction To Work Study	International Labour Office	International Labour Office,1969	Digitalized	2008
04	Operations research	D.S.Hira and Gupta	Chand & Co. New Delhi.	Seventh	1976

Reference Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Industrial Engineering and Management	Khanna O. P.	Dhanpat Rai Publications(P) Ltd, New Delhi	Revised	2003
02	Industrial Engineering and Production Management	Martand Telsang	S. Chand & Company Ltd., New Delhi	Revised	2006
03	Global Management Solutions Demystified	Dinesh Seth, Subhash Rastogi	Cengage learning publications.	Second	2009
04	Industrial Engineering Handbook	H. B. Maynard and Others	Tata McGraw Hill Publication	Fourth	2009

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(An Autonomous Institute)

Department of Mechanical Engineering

T. Y. B. Tech Semester VI

Course Code	Course Name	Teaching Scheme				THEORY							PRACTICAL					GRAND TOTAL
						ISE		MSE+ ESE			Total	Min	ISE	ESE		Total	Min	
		L	T	P	Credits	Max	Min	MSE	ESE	Min				Max	Min			
2MEPC316	Tool Engineering	3	-	2	4	40	16	30	30	24	100	40	25	-	-	25	10	125
2MEPC317	Heat and Mass Transfer	3	-	2	4	40	16	30	30	24	100	40	25	25	10	50	20	150
2MEVS318	Control Engineering Laboratory	-	-	2	1	-	-	-	-	-	-	-	25	25	10	50	20	50
2MEPC319	Computer Aided Manufacturing(CAM) Laboratory	-	-	2	1	-	-	-	-	-	-	-	25	-	-	25	10	25
2MEEL320	Mini Project	-	-	2	2	-	-	-	-	-	-	-	50	-	-	50	20	50
2MECC321	Aptitude and Reasoning Part -IV	-	-	2	1	-	-	-	-	-	-	-	50	-	-	50	20	50
2MEPE3**	Professional Elective-II	3	-	2	4	40	16	30	30	24	100	40	25	-	-	25	10	125
2ME*****	Minor Course - III	3	-	-	3	40	16	30	30	24	100	40	-	-	-	-	-	100
2ILOE3**	Open Elective - II	3	-	-	3	50	20	-	-	-	50	20	-	-	-	-	-	50
		15	**0**	**14**	**23**													**725**
	Total Contact Hours	**29**																

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Professional Elective - II		
Course Code	**Course Name**	**Domain**
2MEPE322	Finite Element Analysis	Design
2MEPE323	Mechanical System Design	
2MEPE324	Condition Monitoring	
2MEPE325	Solar Technology	Thermal
2MEPE326	Computational Fluid Dynamics	
2MEPE327	Alternative Fuels	
2MEPE328	Non Destructive Techniques	Manufacturing
2MEPE329	Modern Manufacturing Processes	
2MEPE330	Metal Joining Process	

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Open Elective Courses		
Course Code	**Course Category**	**Course Name**
2ILOE351	Health Care Management	Economics of Health and Education
2ILOE352	Business Marketing	Business to Business Marketing (B2B)
2ILOE353	Intellectual Property Rights	Patent Law for Engineers and Scientists
2ILOE354		Economics of Innovation
2ILOE355	Business Laws	E-Business
2ILOE356	Finance and Accounting	Management Accounting
2ILOE357	Banking and Insurance	Economics of Banking and Finance Markets
2ILOE358	Investment Management	Quantitative Investment Management
2ILOE359	Human Resource Management	Human Resource Development
2ILOE360	Business Management	Advanced Business Decision Support Systems
2ILOE361	Language	Introduction to Japanese Language and Culture - II
2ILOE362		German - I
2ILOE363	Retail and Channel Management	Operations and Supply Chain Management

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Course Details:

Class			T. Y. B. Tech. Sem.-VI
Course Code and Course Title			**2MEPC316, Tool Engineering**
Prerequisite/s			2MEPC205, 2MEPC206, 2MEPC207, 2MEPC214, 2MEPC303,
Teaching Scheme: Lecture/Tutorial/Practical			03/00/02
Credits			04
Evaluation Scheme	**T**	**ISE/MSE/ESE**	40/30/30
	P	**ISE/ESE**	25/00

Course Outcomes (COs): After successful completion of this course, the student will be able to:	
2MEPC316_1	**Explain** the tool geometry, mechanics of metal cutting and press tools, application of jigs and fixtures, and economic aspect of tooling to perform machining and press operations using fundamentals in tool engineering.
2MEPC316_2	**Compute** the equations and values of cutting parameters, cutting forces and tool life to produce the metallic component using principles in mechanics of metal cutting and conventional lathe machine.
2MEPC316_3	**Calculate** the forces in press work, punch and die dimension, machining time and cost during press work and machining operations using principles and formulas of metal cutting.
2MEPC316_4	**Design** assembly of jig / fixture along with proper justification for a given component using 3-2-1 principle, selecting appropriate type of jig / fixture, locators and clamping system.

Course Contents: Theory		
Unit 1	**Cutting tools:** Fundamentals of metal cutting processes, concept of speed, feed and depth of cut. Tool geometry, angles and types of single point cutting tools, milling, drilling and broaching tool geometry. Cutting tool materials and their properties.	**07 Hrs.**
Unit 2	**Theory of metal cutting:** Mechanics of metal cutting-Chip formation, orthogonal and oblique cutting, Types of chips, cutting ratio, shear plane and shear angle, velocity relationships, force calculations, Merchant circle (numerical). Types of wear and failure, optimum cutting speed, tool life, factors affecting tool life, computation of tool life (numerical). Machinability and factors affecting it.	**06 Hrs.**
Unit 3	**Fundamentals of Jigs and Fixtures:** Applications, basic elements, principles and types of locating, clamping and indexing elements, type of drilling jigs, type of milling fixtures, auxiliary elements like tenon, setting block etc.	**07 Hrs.**

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Unit 4	**Design and drawing of Drilling Jigs and Machining Fixtures:** Design consideration of jigs, design and drawing of drilling jig, design consideration of fixtures with respect to different operations, design and drawing of milling fixtures.	**07 Hrs.**
Unit 5	**Press Tools:** Press Operations, press-type, press components, metal cutting in a press work, types of dies, clearance, strip layout, stripper, cutting forces.	**07 Hrs.**
Unit 6	**Economic aspect of tooling:-** Elements of costs, cost estimation and method of estimating (numerical), Calculations of machining times, Estimation of total unit time, Depreciation, Tool Replacement, Break even analysis (theoretical).	**05 Hrs.**

Course Content: Laboratory

1. One job of plain turning, taper tuning, external threading and knurling operation with its process sheet.
2. Conceptual design and drawing of drilling jig on A3 size drawing sheet for two different components.
3. Conceptual design and drawing of milling fixture on A3 size drawing sheet for two different components.
4. Industrial visit.

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Text Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Text Book of Production Engg.	P.C. Sharma	S. Chand Publication	Eleventh	2008
02	Machine Tool Engg.	G. R. Nagpal	Khanna Publication	Eighth	2013
03	Manufacturing Technology Vol.2	P. N. Rao	McGraw-Hill Publishing Ltd	Seventh	2015
04	A Textbook of Manufacturing Technology - II,	P.C. Sharma	S. Chand Publication	First	2008
05	Textbook of Production Engineering	K. C. Jain, A.K. Chitale	PHI Learning Pvt. Ltd	Second	2014
06	Metal Cutting and Machine Tools	Thirupathi Reddy	Scitech		
07	Metal Cutting and Tool Design	B J Ranganath.	Vikas Publishing House Pvt Ltd	Second	1999
08	Fundamentals of Metal Cutting and Machine Tools	B. L. Juneja	New Age International Pvt Ltd	Second	2017

Reference Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Tool Design	Donaldson	THM Publication	Forth	2012
02	Manufacturing Engg. and Technology	S. Kalpakjian, S. Schmid	Pearson	Seventh	2013
03	Production Technology-	HMT	Tata McGraw-Hill Publishing Ltd	First	Reprint 2001
04	Metal Cutting- Theory and Practice	A. Bhattacharya	New central book agency pvt. Ltd.	First	Reprint 2008
05	Metal cutting theory & Tool design	Mr. Arshinnov	MIR Publication	First	2010
06	Jigs and Fixtures	P. H. Joshi	Tata McGraw-Hill.	Third	2013
07	Metal Cutting Principles	Milton Shaw	Oxford University Press	Second	2012

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Course Details:

Class			T. Y. B. Tech. Sem.-VI
Course Code and Course Title			**2MEPC317, Heat and Mass Transfer**
Prerequisite/s			2MEPC203
Teaching Scheme: Lecture/Tutorial/Practical			03/00/02
Credits			04
Evaluation Scheme	**T**	**ISE/MSE/ESE**	40/30/30
	P	**ISE/ESE**	25/25

Course Outcomes (COs): After successful completion of this course, the student will be able to:	
2MEPC317_1	**Explain** the mechanism and mode of heat and mass transfer by using fundamental principles and concepts
2MEPC317_2	**Apply** the boundary conditions to the differential equations by utilizing heat and mass principles
2MEPC317_3	**Derive** different forms of heat equations for various modes by using principles of heat and mass transfer
2MEPC317_4	**Compute** the heat transfer parameters for a given application on conduction, convection, and radiation by using heat transfer governing equations.
2MEPC317_5	**Analyze** the performance of heat transfer parameters in various application like composite wall, fins, heat exchanger by using principles of heat transfer.

Course Contents:		
Unit 1	**Introduction to Heat Transfer:** **Basic Concepts:** Modes/laws of heat transfer, Combined modes of heat transfer, Thermal conductivity and its variation with temperature. Derivation of Generalized differential equation of Heat Conduction in Cartesian co-ordinates, its reduction to Fourier, Laplace and Poisson's equations. Generalized Heat conduction equation in cylindrical and spherical coordinates (no derivations). **One-dimensional steady state heat conduction without heat generation:** Temperature boundary conditions, heat flux boundary condition, convection boundary condition and radiation boundary condition. Reduction of Generalized differential equation of Heat Conduction to one dimension (1D), Heat conduction through plane wall, cylinder, sphere; electrical analogy; concept of thermal resistance and conductance, composite slab, composite cylinder and composite sphere, critical radius of insulation for cylinder and sphere.	**08 Hrs.**
Unit 2	**Unsteady State Heat Conduction** **One-dimensional unsteady State Heat Conduction** Lumped Heat capacity Analysis, Biot and Fourier number and their significance, (Numerical based on Lumped Heat capacity Analysis).	**06 Hrs.**

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Unit 3	**Heat Transfer Through Extended Surfaces** Types and applications of fins, Heat transfer from rectangular and pin fins (with different boundary conditions). Fin effectiveness and efficiency, Finned heat sinks for electronic cooling applications	**06 Hrs.**
Unit 4	**Heat Transfer Through Convection** **Natural or Free Convection:** Dimensional analysis, Physical significance of dimensionless numbers, correlations for natural convection over vertical plate cylinder sphere and flow patterns **Forced Convection:** Dimensional analysis, Physical significance of dimensionless numbers, Reynolds analogy for laminar flow, correlations for forced convection over flat plate and closed conduits.	**06 Hrs.**
Unit 5	**Heat Transfer Through Radiation** Nature of thermal radiation, absorptivity, reflectivity, transmissivity, emissive power and emissivity, spectural and total concept, black body, gray body and white body. Kirchoff's law, Wein's law and Planck's law, and deduction of Stefan Boltzmann law. Lambert cosine rule, Intensity of radiation. Shape factor and its characteristics. Energy exchange by radiation between two gray surfaces without absorbing medium, concept of radiosity and irradiation. radiation shields.	**06 Hrs.**
Unit 6	**Heat Exchangers And Mass Transfer** **Heat Exchangers:** Classification and types of Heat exchangers, Fouling factor, and Overall heat transfer coefficient, Heat Exchanger Analysis using LMTD and NTU methods for parallel and counter flow, shell and tube type HEX, Design consideration of Heat exchangers **Mass Transfer:** Introduction to mass transfer, Modes of mass transfer, comparison between heat and mass transfer, Fick's law of diffusion, (No numerical treatment)	**07 Hrs.**

Course Content: Laboratory

1. Determination of thermal conductivity of insulating powder
2. Determination of thermal conductivity of metal rod
3. Determination of thermal conductivity of Composite wall or lagged pipe.
4. Determination of heat transfer coefficient for natural convection.
5. Determination of heat transfer coefficient for forced convection.
6. Determination of Emissivity.
7. Determination of Stefan Boltzmann Constant.
8. Determination of critical heat flux by boiling heat transfer.
9. Determination of heat transfer coefficient in drop and film condensation.
10. Trial on heat exchangers.
11. Python program of thermal conductivity
12. Python program on natural convection

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Text Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Heat and Mass Transfer	R K Rajput	S. Chand & Company Ltd., New Delhi	Seventh	2019
02	Fundamentals of Heat and Mass Transfer	R.C. Sachdeva	New Age International	First	2000
03	Heat and Mass Transfer	Dr. D.S. Kumar	S. K. Kataria & Sons, Delhi	Third	2013
04	Heat and Mass Transfer	P. K. Nag	Tata Mc- Graw Hill Publication	Third	2011

Reference Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Heat and Mass Transfer	J P Holman S Bhattacharya	Tata MacGraw Hill, New Delhi	Tenth	2011
02	Heat and Mass Transfer	Yunus. A Cengel	Tata MacGraw Hill, New Delhi	Sixth	2020
03	Heat and Mass Transfer	S C Arora S Domkunwar	Dhanpatrai and Sons, Delhi	Seventh	2012
04	Fundamentals of Heat and Mass transfer	Frank P. Incropera,	John Wiley & Sons	Fifth	2007

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Course Details:

Class			T. Y. B. Tech. Semester-VI
Course Code and Course Title			**2MEVS318, Control Engineering Laboratory**
Prerequisite/s			2MEPC201
Teaching Scheme: Lecture/Tutorial/Practical			00/00/02
Credits			01
Evaluation Scheme	**T**	**ISE/MSE/ESE**	00/00/00
	P	**ISE/ESE**	25/25

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
2MEVS318_1	**Use** the MATLAB environment, employing basic commands for arithmetic, matrix operations, and block diagram reduction
2MEVS318_2	**Analyze** the step responses of first-order and second-order systems using MATLAB.
2MEVS318_3	**Analyze** the stability of various systems using techniques such as Root Locus and Routh-Hurwitz criterion.
2MEVS318_4	**Analyze** the stability of various systems in frequency domain using technique such as Bode plot.

Course Content: Laboratory

1. Introduction to MATLAB environment and basic commands
2. To perform arithmetic Math and Matrix operations using MATLAB
3. Generation & plotting of standard test signals
4. Simulating and analysing step response of first-order and second-order systems
5. Block diagram reduction using MATLAB
6. Use of different methods of representation of transfer function
7. Analysis of time domain specifications of a system
8. Analysis of stability of control system using Root locus
9. Analysis of stability control system in frequency domain
10. Mini project on system design and analysis

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Text Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Control Systems Engineering Using MATLAB	Sivanandam S.N.	Vikas Publishing House Pvt Ltd	Second	2014
02	Engineering Computations An Introduction Using MATLAB And Excel	Musto, J C Howard, W E Williams, R R	Mc Graw-Hill Education (India) Private Limited,	First	2016
03	Getting Started With MATLAB : A Quick Introduction For Scientist And Engineers	Pratap Rudra	Oxford University Press,	First	2018
04	Mastering MATLAB	Hanselman Duane H Littlefield Bruce	Pearson Education South Asia	Seventh	2012

Reference Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	MATLAB	Gilat Amos	Wiley India Pvt Ltd	Fourth	2011
02	MATLAB And Its Application In Engineering	Bansal Raj Kumar	Pearson Education In South Asia,	Fifteenth	2009
03	Undestanding MATLAB	Alam S.N.	I K International Pub House Pvt Ltd	First	2013
04	Modeling And Simulation Using MATLAB Simulink	Jain Shailendra	Wiley India Pvt Ltd	First	2015

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Course Details:

Class			T.Y. B. Tech, Sem.-VI
Course Code and Course Title			**2MEPC319, Computer Aided Manufacturing Laboratory**
Prerequisite/s			2MEPC214, 2MEPC216
Teaching Scheme: Lecture/Tutorial/Practical			00/00/02
Credits			01
Evaluation Scheme:	**T**	**ISE / MSE/ ESE**	00/00/00
	P	**ISE/ ESE**	25/00

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
2MEPC319_1	**Explain** different terms of CAD, CAM and CNC machine.
2MEPC319_2	**Write** part programs for various operations of CNC machine using G and M codes.
2MEPC319_3	**Develop** skills in using CAM simulation software to generate tool path, G and M codes.
2MEPC319_4	**Analyze** the part programs of any industrial part and improvise it.
2MEPC319_5	**Produce** a part on a CNC machine individually or in group using CAD/CAM.

Course Contents: Laboratory

The term work consists of following experiments/assignments.

1. Introduction to CAM, CAPP, CAI, CAQC, CIM.
2. Introduction to NC, CNC and machining centers.
3. Part programming, G and M codes, co-ordinate system.
4. Part program for facing and tool path generation.
5. Part program for turning and tool path generation.
6. Part program for step-turning, grooving and tool path generation.
7. Part program using canned cycles.
8. Part program for pocket milling and tool path generation.
9. Part program for island, contour milling and tool path generation.
10. Part program for drilling and tool path generation.
11. Case study to analyze the existing programs and the ways to improve it.
12. Manufacture a useful part using CAD/CAM tools.
13. Visit to industry related to CNC and CAD/CAM.

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Text Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
1	CAD/CAM	Ibrahim Zeid, R. Sivasubramanian	Tata McGraw Hill Pvt. Ltd.	First	2008
2	CAD/CAM (Principles & Applications)	P.N.Rao	Tata McGraw Hill Pvt. Ltd.	Fifth	2012
3	CAD/CAM	KuldeepSareen, Chandandeep Grewal	S.Chand	First	2009
04	Computer Aided Manufacturing	P.N.Rao, N.K.Tewari, T.K.Kundra	Tata McGraw Hill Publishing company ltd., New Delhi.	Third	2009

Reference Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	CAD/CAM	M.P.Grover, E.W.Zimmer.	Prentice Hall of India Pvt. Ltd.	First	2007
02	CAD/CAM/CIM	Radhakrishnan, Subramanyam,	New Age Int. Publishers.	Third	2008
03	Computer Aided Mechanical Design & Analysis	V. Ramamurti	Tata McGraw Hill Pvt. Ltd.	Fourth	2000
04	CAD/CAM/CAE	N.K. Chougule	Scitech	First	2009
05	CAD/CAM – Concepts and applications	Chennakesava R. Alavala	Prentice Hall of India Pvt. Ltd.	Second	2009

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Course Details:

Class			T. Y. B. Tech. Sem.-VI
Course Code and Course Title			**2MEEL320, Mini Project**
Prerequisite/s			All Courses
Teaching Scheme: Lecture/Tutorial/Practical			00/00/02
Credits			02
Evaluation Scheme	**T**	**ISE/MSE/ESE**	00/00/00
	P	**ISE/ESE**	50/00

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
2MEEL320_1	**Identify** the real life, institutional/ social/ local /industrial problems for sustainable development relevant to societal and environmental issues.
2MEEL320_2	**Analyse** the available literature to find out the research gaps considering the project domain, to identify the objectives and methodology of project work.
2MEEL320_3	**Conduct** the project work as per the designed methodology to arrive on related results and its validation.
2MEEL320_4	**Produce** a comprehensive technical report, demonstrating mastery of the subject matter and proficiency by ethically integrating existing knowledge and their own findings.
2MEEL320_5	**Present** proficiently their research findings and project outcomes effectively using multimedia tools, prototypes of products, and any other relevant visual aids.

Course Contents:

- Project work can be a design project / experimental project and or computer simulation project on mechanical engineering or any of the topics related with mechanical engineering stream.
- Project work may consist of fabrication and experimental work or exhaustive analysis of system in the context of 2-3 factors identified while formulating problem by them or supported by industry.
- Project work consists of two reviews based on work. In the first review, progress of the project work done is to be assessed and in second review, the complete assessment (quality, quantum and authenticity) of the thesis is to be evaluated.
- Each group has to present the work carried out and analysis results obtained in final project evaluation.
- Students have to prepare final project report under the guidance of the project guide. Project report should consist of assembly and details drawing of product/setup/prototype prepared by using CAD software. It should also include bill of material, all geometrical dimensions, limit, fit and tolerances.

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- One copy of the report is expected to be submitted to project guide and one copy should remain with project group.

Project work submitted by students shall include;

1. Work Diary: Work Diary maintained by group and countersigned by the guide weekly. The contents of work diary shall reflect the efforts taken by project group for

a. Searching suitable project work
b. Brief report preferably on journals/ research or conference papers/ books or literature surveyed to select and bring up the project.
c. Day to day activities carried out related to project work for entire semester.

2. Synopsis: The group should submit the synopsis in following prescribed format.

a. Title of Project
b. Names of Students
c. Name of Guide
d. Relevance
e. Present Theory and Practices
f. Proposed work
g. Expenditure
h. References

The synopsis should consist of minimum **eight** review papers. The synopsis shall be signed by each student in the group, approved by the guide and endorsed by the Head of the Department.

3. **Presentation & report:** The group has to make a presentation in front of the faculty members and review panel member at the time of Review's.

Project-I Report Format:

Project report should be of 25 to 30 pages (typed on A4 size sheets). For standardization of the project reports the following format should be strictly followed.

1. Page Size: Trimmed A4
2. Top Margin: 1.00 Inch
3. Bottom Margin: 1.32 Inches
4. Left Margin: 1.5 Inches
5. Right Margin: 1.0 Inch
6. Para Text: Times New Roman 12 Point Font
7. Line Spacing: 1.5 Lines
8. Page Numbers: Right Aligned at Footer. Font 12 Point. Times New Roman
9. Headings: Times New Roman, 14 Point , Bold Face
10. References: References should have the following format

For Papers: Authors, "Title of Paper", " Journal/Conference Details", Year
For Books: Authors, "Title of Book", Publisher, Edition

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Course Details:

Class			T. Y. B. Tech. Sem.-VI
Course Code and Course Title			**2MECC321, Aptitude and Reasoning Part -IV**
Prerequisite/s			2MECC211, 2MECC221, 2MECC306
Teaching Scheme: Lecture/Tutorial/Practical			00/00/02
Credits			01
Evaluation Scheme	**T**	**ISE/MSE/ESE**	00/00/00
	P	**ISE/ESE**	50/00

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
2MECC321_1	**Solve** problem based on basic and advance probability, Permutation and Combination
2MECC321_2	**Solve** problem based on Syllogism, graphs, data interpretations
2MECC321_3	**Solve** problem based on gaming round
2MECC321_4	**Demonstrate** on Resume writing skill, closed, advanced grammar, Synonyms and Antonyms

Course Contents:		
Unit 1	**Advance Probability** **Advance Permutation** **Combination**	**04 Hrs.**
Unit 2	Statement Assumption Syllogism	**04 Hrs.**
Unit 3	Mixed Bar Graph, Pie Chart Data Interpretation(Avg & Ratio Proportion based)	**04 Hrs.**
Unit 4	Gaming Round OR Capgemini Part 1 Gaming Round OR Capgemini Part 2	**04 Hrs.**
Unit 5	Company Specific Revision for Arithmetic (S.T.D., Time Rate Work) Revision of Calendar Reminder theorem Power Cycle	**04 Hrs.**
Unit 6	Verbal Ability Revision Part 1 Verbal Ability Revision Part 2 Interview Etiquettes & Grooming	**04 Hrs.**

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Text Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Quantitative Aptitude for Competitive Examinations	R.S. Agarwal	S Chand	Revised	2022
02	A Modern Approach to Verbal & Non-Verbal Reasoning	R.S. Agarwal	S Chand	Revised	2024
03	English Grammar And Composition	P C Wren, H Martin	S Chand	Second	2019

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Course Details:

Class			T. Y. B. Tech. Sem.-VI
Course Code and Course Title			**2MEPE322, Finite Element Analysis**
Domain			**Design**
Prerequisite/s			2MEPC204,2MEPC213,2MEPC301
Teaching Scheme: Lecture/Tutorial/Practical			03/00/02
Credits			04
Evaluation Scheme	**T**	**ISE/MSE/ESE**	40/30/30
	P	**ISE/ESE**	25/00

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
2MEPE322_1	**Explain** the fundamental concepts of theory of elasticity and software implementation for static structural and thermal concepts with FEM approach.
2MEPE322_2	**Apply** the finite element formulations for 1D and 2D problems by using finite element method.
2MEPE322_3	**Compute** unknown variables in structural and thermal analysis by using finite element formulations.
2MEPE322_4	**Analyze and interpret** results of 1D, 2D and 3D problems by using the potential energy approach, Galerkin's method and Analytical Tools.

Course Contents: Theory		
Unit 1	**Fundamental Concepts** Introduction, Past, present and future of FEA, Stresses and Equilibrium, Boundary Conditions, Strain-Displacement relations, Stress-Strain Relations, Potential energy and equilibrium, Galerkins method, Von-Mises stresses.	**07 Hrs.**
Unit 2	**One Dimensional Problem** Introduction, Finite element modelling (element division, numbering scheme), coordinates and shape functions, the potential energy approach(element stiffness matrix, force terms), Galerkin approach (element stiffness matrix, force terms),Assembly of the global stiffness matrix and load vector, properties of K, the finite element equations; treatment of boundary conditions(types of boundary conditions), elimination approach.	**07 Hrs.**
Unit 3	**Two-Dimensional Problems using Constant Strain Triangles** Introduction, finite element modelling, Constant Strain Triangle (CST), Iso - parametric representation, potential-energy approach, element stiffness, force terms, Galerkin approach, stress calculations, problem modelling and boundary conditions.	**06 Hrs.**

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Unit 4	**Analysis of Trusses** **Trusses:**-Plane trusses, Local and Global coordinate systems, formulas for calculating L and M, element stiffness matrix, Stress Calculations, Assembly of global stiffness matrix.	**06 Hrs.**
Unit 5	**Analysis of Thermal Problems** Introduction, steady state heat transfer, One dimensional heat conduction, One dimensional heat transfer in thin fins, Two dimensional steady state heat conduction.	**06 Hrs.**
Unit 6	**Computer Implementation of the Finite Element Method:** **Pre-processing**: Model definition – nodal coordinates element connectivity, material and element type and property definitions, type of analysis (static/modal), loading and boundary conditions. Meshing techniques- free and mapped meshing, Quality checks – aspect ratio, warp angle, skew, distortion, stretch, included angle, taper **Processing**: Element level calculations, Equation assembly, Equation solver (sparse solvers, factorization, numerical/computational issues) **Post Processing**: Strain and stress recovery (integration and nodal points), interpretation of results (results validation and data interpretation) and design modification.	**07 Hrs.**

Course Contents: Laboratory

The term work consists of following experiments:

1 Static structural analysis of 1D Bar using ANSYS.

2 Static structural analysis of 1D Bar using Python.

3 Static structural analysis of Beam using ANSYS.

4 Static structural analysis of Truss using ANSYS.

5 Static structural analysis of 3D component using ANSYS Workbench. (Mesh Convergence using Parameters Set).

6 Static structural analysis of 3D component with Stress concentration geometry using ANSYS Workbench. (Define Path to find results)

7 Steady state analysis of 1D or 2D Fin using ANSYS.

8 Buckling Analysis of Column using ANSYS.

9 Model Analysis of Component using ANSYS.

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Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Introduction to Finite Elements in Engineering	Chandrapatala, Belgundu	PHI	Third	2012
02	Finite Element Methods for Engineers	U.S. Dixit	Cengage	Fourth	2011
03	An Introduction to Finite Element Method	J. N. Reddy	McGraw Hill	Second	1993
04	Finite Element Analysis –Theory and Practice	M.J.Fagan	Longman Scientific & Tech.	---	---
05	Textbook of Finite ElementsAnalysis	P. Sheshu	Prentice-Hallof India Limited	---	---
06	"Practical Finite Element Analysis	N.S. Gokhale, S.S. Deshpande	Finite to Infinite	---	2008
07	A First Course in the Finite Element Analysis	D.L.Logan	CENGAGE Learning	Seventh	2011

Reference Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
01	An Introduction to Finite Element Analysis	Barna Szabo, Ivo Babuska	---	---	---
02	Finite Element Methods for Engineers	S.S.Rao	--	--	---
03	Finite Element Analysis Theory and Application With ANSYS	Saeed Moaveni	Prentice Hall	Third	----
04	Finite Element Simulations With ANSYS Workbench 14 Perfect Paperback – Import, 11 Jun 2012	Huei-Huang Lee	Schroff DevelopmentCorp	First	2012
05	Ansys Workbench TutorialRelease 14: Structure & Thermal Analysis	Kent L. Lawrence	Schroff Development	Second	2012
06	Finite Element Analysis Using Ansys 11.0 Paperback	Srinivas Paleti	PHI	First	2010

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Course Details:

Class			T.Y. B. Tech, Sem.- VI
Course Code and Course Title			**2MEPE323, Mechanical System Design**
Domain			**Design**
Prerequisites			2MEPC204,2MEPC213
Teaching Scheme: Lecture/Tutorial/Practical			03/00/02
Credits			04
Evaluation Scheme	**T**	**ISE/MSE/ESE**	40/30/30
	P	**ISE/ESE**	25/00

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
2MEPE323_1	Explain the principles of aesthetic, ergonomic, rational, and optimal design applied to various products, machines, and mechanical systems by comprehending their utilization in existing applications.
2MEPE323_2	Derive the expressions for various components of a mechanical system by acquiring knowledge of the design processes.
2MEPE323_3	Compute the dimensions of the components of a mechanical system by following a standard design process.
2MEPE323_4	Design the components of a mechanical system in accordance with the given specifications using design data/ catalogs or optimization methods.

Course Content: Theory		
Unit 1	**Aesthetic and Ergonomic Considerations in Design:** Aesthetic Design- Basic aspects/principles: product form &its types, designing for appearance, shape, materials, finishes, proportions, symmetry, contrast etc., Morgan's colour code, Practical examples of products or equipment's using aesthetic design principles. Ergonomic Design- Relation between man, machine and environmental factors, Design of displays and controls, Practical examples of products or equipment's using ergonomic design. Creativity concept in design.	**06 Hrs.**
Unit 2	**Design of Pressure Vessels:** Types of pressure vessels & its general applications, Failure criteria for pressure vessels: Lame's, Clavarino's and Birnie's equation for thickness calculations (Numerical treatment), Classification of unfired pressure vessel as per IS2825:1969 code, Design parameters, thickness calculations of end closures (Numerical treatment), Types of pressure vessel support, Compensation of openings due to openings & nozzles in pressure vessel.	**07 Hrs.**
Unit 3	**Design of Clutch System:** Introduction, Classification of clutches, Design requirement of friction clutch, Selection criteria of clutches. Torque transmitting capacity of clutches: single	**07 Hrs.**

	plate, multi-plate clutch, centrifugal clutch (Numerical treatment)	
Unit 4	**Design of Braking System:** Classification of brakes, Basic design consideration in brakes, Braking torque capacity: Block brake, Drum & shoe brake, Disk brake (Numerical treatment).	**06 Hrs.**
Unit 5	**Design of Belt Conveyor System:** Types of conveyors, Flat & troughed belt conveyor components: rubber covered steel cord/rope & fabric ply belt, pulleys, idlers, tension take-up units. Design of belt conveyor system: Capacity calculation, determination of various force acting on belt by conveyor components, belt tensions, estimation of power requirement of conveyors etc. (Numerical treatment)	**06 Hrs.**
Unit 6	**A) Optimum Design:** Concept of optimum design, Different methods & techniques of optimization. Johnsons Method of Optimum Design: design parameters, primary, subsidiary & limit equations. Optimum design with normal specifications of mechanical/machine components like tension bar, beam & spherical pressure vessel. (Numerical treatment). **B) Design for manufacture, assembly and safety:** General principles of design for manufacture and assembly (DFM and DMFA), Design principles for maintainability, Design for machining, Design for safety.	**07 Hrs.**

Course Content: Laboratory

1. Case study on Aesthetic and Ergonomic design considerations used in design of domestic/industrial products or machines.
2. Design of Pressure vessel as per IS code and draw its assembly & details.
3. Design of Disc brake system used for 2/4 wheeler Vehicles.
4. Design of Gear pump used in hydraulic applications.

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Text Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Design of machine elements	V.B. Bhandari	Tata Mc- Graw Hill Publication	Third	2012
02	Mechanical System Design	S.P.Patil	Jaico Publication House,New Delhi	First	2004
03	Design of Machine Elements	P. Kannaiah	Scitech Publication.	Second	2008
04	Machine Design	R. K. Jain	Khanna Publication	Seventh	2004
05	Process Equipment Design	M. V. Joshi	Machmillan India Ltd.,New Delhi	Third	1996

Reference Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Theory and Design of pressure vessels	John F.Harve	CBS Publishers	First	2001
02	Mechanical Engineering Design	Shigley and C.R.Miscke	Tata Mc- Graw Hill	Eighth	2010
03	Design of Machine Elements	M.F.Spotts	Pearsons Edu. Inc.	Eighth	2004
04	Design of Machine Element	J.F. Shigley	McGraw Hill Publication.	Eighth	2010
05	Design Data: Data Book of Engineers	PSG College, of technology	Kalaikathir Achchagam, Coimbatore, India	--	1994
06	Design data book	V.B. Bhandari	Tata Mc- Graw Hill Publication	First	2014
07	IS Codes for Pressure Vessel Design	--	Bureau of Indian standards, New Delhi	Eight	1998

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Course Details:

Class			TY B. Tech. Semester- VI
Course Code and Course Title			**2MEPE324, Condition Monitoring**
Domain			**Design**
Prerequisite/s			2MEPE307
Teaching Scheme: Lecture/Tutorial/Practical			03/00/02
Credits			4
Evaluation Scheme:	**T**	**ISE/ MSE / ESE**	40/30/30
	P	**ISE/ESE**	25/00

Course Outcomes (COs): Upon successful completion of this course, the students will be able to:	
2MEPE324_1	**Explain** the types of machinery maintenance ,condition monitoring and fault diagnosis procedures
2MEPE324_2	**Apply** the condition monitoring technique to evaluate and predict the condition of the machine
2MEPE324_3	**Analyze** the signals of machine parameters to pinpoint the machinery faults
2MEPE324_4	**Evaluate** unbalance condition, grade of unbalance of a rotor and carry out site balancing
2MEPE324_5	**Rectify** the mechanical faults in the machinery to reduce vibration , noise and temperature of the machine

Course Contents: Theory		
Unit 1	**Introduction to Machinery maintenance:** Importance of machinery maintenance. Types of machinery maintenance- Break down maintenance, Time base maintenance, Condition based maintenance. Concept of preventive maintenance using condition monitoring. Machinery monitoring parameters-vibration, Noise, Oil debris, Temperature, wear	**06 Hrs.**
Unit 2	**Vibration condition monitoring:** Concept of vibration monitoring. Principle of vibration condition monitoring, Selection of vibration parameters for condition monitoring. Procedure of vibration monitoring, vibration monitoring locations, vibration monitoring data sheets, Vibration severity criteria ISO;2372, ISO:10816+, Interpretation of machine condition. Time interval for vibration monitoring	**07 Hrs.**
Unit 3	**Machinery fault diagnosis:** Mechanical faults in machines and their vibrational characteristics: -Unbalance, misalignment, looseness, faulty bearings, faulty gears, critical speed of the shaft, foundation problems Procedure of fault diagnosis: -Trend analysis, Frequency spectrum analysis and phase analysis for fault diagnosis	**07 Hrs.**

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Unit 4	**Balancing of machinery rotors** Single plane unbalance, Two plane unbalance Instruments for balancing the rotors at site, Single plane balancing of rotor using vector method, Single plane and two plane balancing by using FFT analyser. Selection of balance mass, Splitting of balance mass, Balancing grade and tolerance.	**06 Hrs.**
Unit5	**Alignment of shafts and Rectification of bearing problems:** Procedure of alignment of shafts by dial gauge and filler gauge, Use of laser alignment, Alignment of machinery shafts subjected to thermal distortion Bearing mounting procedure, Rectification of looseness and bearing misalignment.	**06 Hrs.**
Unit 6	**Miscellaneous monitoring techniques:** Temperature monitoring, Thermography, Thermal image analysis, Oil debris analysis, Procedure of oil debris analysis. Ferometry, Magnetic plugs. Noise monitoring and analysis. Machine learning and Artificial intelligence for condition monitoring: Introduction to machine learning and artificial intelligence techniques applied to the condition monitoring and predictive maintenance of industrial machines.	**07 Hrs.**

Course Contents: Laboratory

1. Measurement of overall vibrations of rotating machine to judge machine condition by using vibration severity chart
2. Frequency spectrum analysis of rotating machine for fault diagnosis
3. Single plane balancing of rotor using FFT analyser
4. Two plane balancing of rotor by using FFT analyser
5. Bearing condition monitoring and analysis
6. Alignment of shafts using dial gauge, filler gauge
7. Alignment of shaft using laser technique
8. Octave band analysis of machinery noise
9. Case study on vibration condition monitoring and fault diagnosis

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Text Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Machinery condition monitoring	Amiya Rajan Mohenty	CRC press Tylor and Francis group	First	--
02	Condition Monitoring of Industrial machinery	Ramesh Kumar	LAMBERT Academic Publishing Co.	First	--
03	Condition monitoring with vibration signals	Ashok Nandi , Hosameldin Ahamad	John Wiley and Sons	First	2020

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Course Details:

Class			T. Y. B. Tech. Sem.-VI
Course Code and Course Title			**2MEPE325, Solar Technology**
Domain			**Thermal**
Prerequisite/s			2MEPC203
Teaching Scheme: Lecture/Tutorial/Practical			03/00/02
Credits			04
Evaluation Scheme	**T**	**ISE/MSE/ESE**	40/30/30
	P	**ISE/ESE**	25/00

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
2MEPE325_1	**Calculate** the solar geometry angle for given condition and location by using fundamentals of mathematics and thermodynamics.
2MEPE325_2	**Describe** different solar applications such as low temperature, medium and high temperature, PV cell
2MEPE325_3	**Analyse** different solar collector and its performance of different types by using fundamentals of thermodynamics.
2MEPE325_4	**Describe** importance of energy audit, Environmental and Social Impacts of Solar Energy
2MEPE325_5	**Design** solar PV system for given condition by using solar PV technology.

Course Contents: Theory		
Unit 1	**Introduction:** Renewable energy sources, Indian scenario, need, characteristics and challenges in the successful utilization of renewable energy sources, **Solar energy resources:** Energy from the sun, solar extra-terrestrial radiation, spectral distribution, earth sun angles, observer sun angles, tilt factor, solar radiation intensity incident on tilted surface, measurement of solar radiation	**07 Hrs.**
Unit 2	**Low temperature application of solar thermal energy** Water and air heating application, flat plate collector, classification, types, losses, performance evaluation, storage, testing and standards **Medium and high temperature applications of solar thermal energy** Concentrating collectors, classification, types and suitability, tracking, performance evaluation, industrial process heating systems, solar thermal power generation, technologies, storage issues and challenges in the commercialization	**06 Hrs.**
Unit 3	**Solar photovoltaic conversion** Basic semiconductor physics, a generic photovoltaic cell, modules and arrays, use of solar cell in various instruments, impact of temperature and shading on the performance of a PV module	**07 Hrs.**

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Unit 4	**Solar photovoltaic Design** Solar photovoltaic systems and components, Design of standalone PV system, calculations, and technical aspects. Grid connected PV system types and component and technical aspects	**06 Hrs.**
Unit 5	**Auditing and economics of energy** Types of energy audits, methodology, instruments used in energy auditing, protocol, carbon footprint, carbon credit and clean development mechanism (CDM) **Economic analysis:** Introduction, initial and annual costs, definitions, annual solar saving, payback period, life cycle savings P1, P2 methods	**07 Hrs.**
Unit 6	**Environmental and Social Impacts of Solar Energy:** Environmental benefits and challenges associated with solar energy deployment, including land use impacts, material sourcing, and end-of-life disposal. Financing options for solar projects, including subsidies, tax incentives, and third-party financing models.	**06 Hrs.**

Course Content: Laboratory

1. Demonstration of measurement of solar radiation
2. Demonstration of solar water heating system
3. Identify and measure the parameter of a solar PV module in the field
4. Efficiency measurement of standalone solar PV system
5. Case study on solar PV system installed in any organization and report
6. Demonstration of instruments used in energy audit.
7. Energy audit: Case study of any manufacturing industry and report.
8. Energy audit: Case study of residential building and report.
9. Industrial Visit

Text Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
01	Solar Energy	Sukhatme S.P	Tata McGraw Hill New Delhi	Third	2006
02	An Introduction to Power plant Technology	Rai G.D.	Khanna Publishers	Third	2011
03	Principle of solar engineering	Krieth and Krieder	Tata McGraw Hill New Delhi	Second	2000
04	Solar Engineering of Thermal Processes	Duffie John A. Beckman William A	John Wiley and Sons, Inc.	Second	2009

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Reference Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Handbook of solar energy	-	Springer	First	2015
02	Energy conservation	-	National productivity Council (NPC) & Petroleum Conservation Assn. (PCRA).	Second	2017
03	Solar Energy	Walker Andy	John Wiley and Sons, Inc.	First	2013
04	Solar Photovoltaics Technology, system Design, Reliability and Vialbility	N.D. Kaushika, Anuradha Mishra, Anil Rai	Springer	First	2018

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Course Details:

Class			T.Y. B. Tech, Sem.-VI
Course Code and Course Title			**2MEPE326, Computational Fluid Dynamics**
Domain			**Thermal**
Prerequisite/s			2MEPC212, 2MEPC302
Teaching Scheme: Lecture/Tutorial/Practical			03/00/02
Credits			04
Evaluation	**T**	**ISE / MSE / ESE**	40/30/30
	P	**ISE/ESE**	25/00

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
2MEPE326_1	**Explain** the governing equations of fluid flow, methodology of grids generation and discretization, algorithms and turbulence modeling by considering different assumptions of fluid flow.
2MEPE326_2	**Distinguish** discretization methods, grids, boundary conditions, turbulence models etc. by using the principles of CFD for given application.
2MEPE326_3	**Apply** the appropriate mesh element, boundary conditions, turbulence models and algorithms for different applications with accuracy.
2MEPE326_4	**Evaluate** the performance/fluid flow parameters and interpret the flow pattern for the given application by using CFD techniques.

Course Contents: Theory		
Unit 1	**Introduction to Computational Fluid Dynamics & Principles of Conservation** Introduction to Computational Fluid Dynamics, CFD Applications, Numerical vs. Analytical vs. Experimental, Modeling vs. Experimentation, typical problems, Governing equations of fluid flow (mass, momentum, energy), Basic equations of heat transfer, Working of Commercial CFD Software, Solution methodology-pre-processing, Solver, Post processing.	**06 Hrs.**
Unit 2	**Basics of discretization & Grid generation** Basic concepts of discretization, Discretization techniques - Finite difference, Finite volume and Finite element method, Comparison of discretization methods, Boundary conditions and types, Structured and unstructured grid. Grid independence study, Other grid types.	**06 Hrs.**
Unit 3	**Finite Difference Method** Taylor Series Expansions, Finite difference equations, Forward, Central, Backward Numerical error, Explicit, Implicit, Semi-implicit (Crank- Nicholson method). Alternate directional implicit, Applications. 1-D examples, 2-D examples.	**08 Hrs.**

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Unit 4	**Finite Volume Method: Diffusion processes** Introduction, Generic form of conservation equations, FVM for 1D steady state Diffusion, FVM for 2D steady state Diffusion, Unsteady diffusion Explicit and Implicit approach (alternate direction implicit).	**07 Hrs.**
Unit 5	**Finite Volume Method: Convection-Diffusion processes** Introduction, 1-D Convection and Diffusion, Central Differencing, Upwind Differencing, QUICK scheme.	**05 Hrs.**
Unit 6	**Introduction to solution algorithms and turbulence modeling** Introduction, staggered grid, introduction to SIMPLE, SIMLEC, SIMPLER, PISO algorithms. Introduction to turbulence, Transition from laminar to turbulent flow; Effect of turbulence on time averaged Navier -Stokes equations; Characteristics of simple turbulent flows; Introduction to Turbulent Models like Mixing length Model, k-epsilon model, Reynolds stress equation models	**07 Hrs.**

Course Contents: Laboratory

The term work consists of following experiments:

1. Development of geometry with design modular.
2. Generation of Mesh with Ansys Mesher.
3. Fluid Flow and heat transfer analysis of pipe flow.
4. Fluid flow and heat transfer analysis of Mixing Tee.
5. External fluid flow simulation over an airfoil.
6. Heat and fluid flow analysis in Multi-species flow.
7. Heat dissipation simulation from electronic cooling with natural convection and radiation.
8. Fluid flow simulation of turbine to analyze the performance.
9. Simulation of transient flow model.
10. Case study on real life application.

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Text Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Computational Fluid Dynamics	Gautam Biswas	Narosa Publishing House, New Delhi	Third	2013
02	Fundamentals of Incompressible Fluid Flow	Babu V	Anne Books Pvt Ltd. New Delhi, India	First	2010
03	Introduction to Fluid Dynamics	Batchelor G. K.	Cambridge University Press. New Delhi, India	Second	1999
04	Fluid Dynamics	Raisinghania M.D.	S Chand & Company, New Delhi	Fifth	2003

Reference Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Computational Fluid Mechanics the Basics with applications	Anderson J. D. Jr.	McGraw Hill Education Pvt. Ltd.	Sixth	2014
02	An introduction to computational fluid dynamics; the finite volume method	H. K. Versteeg and W. Malalasekera	Pearson Publication	Second	2009
03	Numerical heal transfer fluid flow	Suhas V. Patankar	Taylor & Francis	First	2014
04	Computational fluid dynamics	T. J. Chung	Cambridge University Press.	Third	2014
05	Computational Fluid Dynamics: A Practical Approach	Jiyuan Tu, Guan Heng Yeoh, Chaoqun Liu,	Butterworth – Heinemann	Second	2008

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Course Details:

Class			T. Y. B. Tech. Sem.-VI
Course Code and Course Title			**2MEPE327, Alternative fuels**
Domain			**Thermal**
Prerequisite/s			2MEPC203
Teaching Scheme: Lecture/Tutorial/Practical			03/00/02
Credits			03
Evaluation Scheme	**T**	**ISE/MSE/ESE**	40/30/30
	P	**ISE/ESE**	25/00

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
2MEPE327_1	**Describe** need for alternative fuels for heat engine and alternative drive systems by considering power requirement under the storage and transportation conditions for power systems
2MEPE327_2	**Compare** various properties, methods of production of various fuels like Bio gas, methanol, ethanol, Bio diesel as per the available production process under the environmental conditions and its availability.
2MEPE327_3	**Selection** of alternative fuels and its application for power systems and alternative drive systems by considering its classification as per the environmental conditions.
2MEPE327_4	**Apply** the various aspects of duel fuel availability as required and power requirement by understanding the pollution norms.
2MEPE327_5	**Compute** the performance of a available alternate fuel for the given power generating systems.

Course Contents: Theory		
Unit 1	**Introduction:** Types of energy sources, their availability, need of alternative energy sources, Non-conventional energy sources, Classification of alternative fuels and drive trains. Scenario of conventional auto fuels, oil reserves of the world. Fuel quality aspects related to emissions. Technological up gradation required business driving factors for alternative fuels. Implementation barriers for alternative fuels. Stakeholders of alternative fuels, Road map for alternative fuels	**08 Hrs.**
Unit 2	**Biogas:** History, properties and production of Biogas, classification of biogas plants, biogas storage and dispensing system. Advantages of biogas, hazards and emissions of biogas. Production, properties, Engine performance, advantages and disadvantages of Methanol, Ethanol, Butanol, Straight vegetable oil, Biodiesel for internal combustion engine application.	**06 Hrs.**
Unit 3	**Hydrogen**: Properties and production of hydrogen, Storage, Advantages and	**06 Hrs.**

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	disadvantages of hydrogen, use of Hydrogen in SI and CI engines. Hazards and safety systems for hydrogen, hydrogen combustion. Emission from hydrogen. **Gaseous fuels:** Production, properties, Engine performance, advantages and disadvantages of CNG, LPG	
Unit 4	**Reformulated Conventional Fuels:** Introduction. Production of coal water slurry, properties, as an engine fuel, emissions of coal water slurry, Emulsified fuels. Hydrogen-enriched gasoline. **Future Alternative Fuels:** Production, properties, Engine performance, advantages and disadvantages of Ammonia, Liquid-Nitrogen, Boron, Compressed Air, Water as fuel for Internal combustion Engine.	**07 Hrs.**
Unit 5	**Duel fuel :** History of dual fuel technology, Applications of DFT. Duel fuel engine operation. Advantages and disadvantages of duel Fuel technology.	**05 Hrs.**
Unit 6	**Vegetable oil as a Fuel :** Various vegetable oils for engines; Esterification Performance in engines; Biogas in engines; Performance and Emission characteristics; Shale oil, coal liquid and Tars and fuel; Performance and Emission characteristics	**07 Hrs.**

Course Content: Laboratory

1. Testing and measurement of calorific value of gaseous fuels.
2. Testing and measurement of calorific value of liquid fuels.
3. Testing and measurement of calorific value of biomass fuels.
4. Demonstration of flue gas analyzer and gas analysis
5. To study and performance analysis of Biodiesel used in 4 Stroke Petrol Engine
6. To study and performance analysis of Hydrogen used in 4 Stroke Petrol Engine
7. To study and performance analysis of CNG used in 4 Stroke Petrol Engine
8. To study and performance analysis of Ethanol used in 4 Stroke Petrol Engine
9. Visit to Duel fuel distribution plant / pump / gas distribution center

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Text Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
1	Alternative Fuel	S .S. Thipse	Jaico Publishing House (First Edition)	First	2010
2	Non-Conventional Energy Sources	G.D.Rai	Khanna Publishers	--	1988
3	Alternative Fuels Guidebook	Richard L. Bechtold	SAE International	--	1997
4	Internal Combustion Engines|	V Ganesan	Tata McGraw Hill Education	Fourth	2017

Reference Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
1	Internal Combustion Engine Fundamentals	John Heywood	Tata McGraw Hill Education	First	2017
2	Alternative energy sources	Efstathios E. Stathis Michaelides	Springer Science & Business Media	Illustrated	2012
3	Alternative Fuels for Road Vehicles	M.L. Poulton	WIT Press	Illustrated	1994

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Course Details:

Class			TY B.Tech, Sem.-VI
Course Code and Course Title			**2MEPE328, Non Destructive Techniques**
Domain			**Manufacturing**
Prerequisite/s			2MEPC214
Teaching Scheme: Lecture/Tutorial/Practical			03/00/02
Credits			04
Evaluation	**T**	**ISE / MSE / ESE**	40/30/30
	P	**ISE/ESE**	25/00

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
2MEPE328_1	**Explain** the construction, working, applications and difference of Non-destructive testing equipments with basic theory of different Non-destructive testing methods.
2MEPE328_2	**Apply** the Non-destructive testing methods for detection of surface and sub-surface defects using standard procedures of conducting the testing.
2MEPE328_3	**Solve** the problems to locate the defect in the component under test by applying the ultrasonic wave theory for flaw determination.
2MEPE328_4	**Select** the appropriate testing techniques to examine the component as per raw material and manufacturing process.

Course Contents:		
Unit 1	**Introduction:** What is NDT, comparison and difference between DT & NDT, Importance and scope of NDT, Methods, problems and difficulties of NDT, Selection of NDT process, Future and economic aspects of NDT	**05 Hrs.**
Unit 2	**Ultrasonic testing:** Principle, wave propagation, types of waves, frequency, velocity, wavelength, reflection, divergence, attenuation, mode conversion in ultrasonic, UT testing methods, contact testing and immersion testing, normal beam and straight beam testing, angle beam testing, dual crystal probe testing, resonance testing, through transmission testing, pulse echo testing, instruments used in UT, accessories such as transducers, testing of materials such as products like plates and round bars, weld joints, castings, forgings UT of non metals, defects in different products.	**07 Hrs.**
Unit 3	**Radiography testing:** Basic principle, Electromagnetic radiation sources: X-ray source, production of X-rays, high energy, X-ray source, gamma ray source, radiography, Standards, advantages and limitations, panoramic exposure, real time radiography, films used in industrial radiography, quality of a good radiograph, film processing interpretation, evaluation of test results. Inspection techniques like SWSI, DWSI, DWDI,	**07 Hrs.**

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Unit 4	**Eddy current testing :** Principle of ECT, physical aspects of ECT like conductivity, permeability, resistivity, inductance, inductive reactance, impedance etc., field factor and lift of effect edge effect, end effect, impedance plane diagram in brief, Depth of penetration of ECT: relation between frequency and depth of penetration in ECT, Equipments and accessories, various application of ECT such as conductivity measurement, hardness measurement, defect detection, coating thickness measurement, coating of materials etc.	**06 Hrs.**
Unit 5	**Magnetic particle testing:** Principles of MPI, basic physics of magnetism, permeability, flux density, cohesive force, magnetizing force, resistivity, residual magnetism etc., methods of magnetization, magnetization techniques such as head shot technique, cold shot technique, central conductor testing, magnetization using products using yokes, direct method magnetism, indirect method of magnetization. Continuous testing of MPI, residual technique of MPI, system sensitivity, checking devices in MPI, interpretation of MPI, indications, advantage and limitation of MPI.	**07 Hrs.**
Unit 6	**Dye penetrant testing:** Principles of DPT, qualification, of penetrant testing consumable, properties required in a good penetrant and development which are used as consumable in dye penetrant testing, types of penetrant, types developers, use of various types of penetrant and developers for various application, DPT technique, test procedure, interpretation and evaluation of penetrant test indication such as relevant indications, non relevant indications, false indication, safety precaution required in penetration testing. **Acoustic Emission Testing:** Principle of acoustic emission testing, testing process, AE source location methods, instrumentation, applications, advantages.	**07 Hrs.**

Course Content: Laboratory

1. Examination the surface defects using the Visual Testing.
2. Examination of the surface defects using the Liquid Penetrant Testing.
3. Determination of Surface and Subsurface Defects using the Magnetic Particle Inspection.
4. Basic Calibration of the Ultrasonic Testing Machine using Angle beam probes.
5. Calibration of Normal Beam probe and thickness measurement with UT.
6. Determination of the defects in the Welded Joints using the angle probe.
7. Determination of the defects in the shafts using the normal probe.
8. Case study on any non-destructive testing method.
9. Industrial Visit.

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Text Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Basics of Non-Destructive Testing	Lari, Kumar	S.K. Kataria & Sons	Fourth	2013
02	Non-Destructive Testing Techniques	Ravi Prakash	New Age International Private Limited	Fourth	2010
03	Non-destructive Evaluation - A tool in Design, Manufacturing and Service	D.E. Bray and R. K. Stanley	CRC Press,	Eightth	1996
04	Non-Destructive Testing	Ramchandran S.	AIR WALK Publications (India)	First	2017

Reference Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Non-destructive testing	Krant krammer	McGraw Hill Education	Fifth	2012
02	Practical NDT	Baldev Raj	Narosa Book Distributors	Fourth	2010
03	Ultrasonic Testing of Materials	Josef Kraut kramer, Herbert Krautkramer	Springer-Verlag	Fourth	1990
04	Non-Destructive Test and Evaluation of Materials	J Prasad, C. G. Krishnadas Nair	McGraw Hill Education	Second	2011

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(An Autonomous Institute)
Department of Mechanical Engineering

Course Details:

Class			T. Y. B. Tech. Sem.-VI
Course Code and Course Title			**2MEPE329, Modern Manufacturing Processes.**
Domain			**Manufacturing**
Prerequisite/s			2MEPC214
Teaching Scheme: Lecture/Tutorial/Practical			03/00/02
Credits			04
Evaluation Scheme	**T**	**ISE/MSE/ESE**	40 /30/30
	P	**ISE/ESE**	25/00

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
2MEPE329_1	**Explain** the basic principle of CNC machine to perform machining operations using various programming techniques.
2MEPE329_2	**Choose** the modern manufacturing methods to cut metals, glass, plastic by using the basic principle, mechanism and components of non-conventional machining processes.
2MEPE329_3	**Classify and select** additive manufacturing process for a given application by using mechanism of various additive manufacturing processes.
2MEPE329_4	**Examine** the composite material in terms of various properties through various mechanical testing techniques.
2MEPE329_5	**Select** the manufacturing process to produce the various components required in industry using the fundamental knowledge of different manufacturing processes.

Course Contents: Theory		
Unit 1	**Advances in Numerical Control Machines** Classification and Construction details of CNC machines, Machine structure, guideways, Spindle drives, feed drives, Configuration of CNC system , APT Programming, Adaptive control in CNC systems.	**06 Hrs.**
Unit 2	**Modern Machining Processes** Introduction, Historical background, Classification, Hybrid processes, Macro/micro/nano machining, process capabilities and related comparison. Principle, equipment, processes parameters & applications of Abrasive Jet Machining (AJM), Water Jet Machining (WJM), Ultrasonic Machining (USM),Numerical.	**07 Hrs.**

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Unit 3	**Thermo-electric & Electro-chemical Processes** Introduction, principle, equipment, process parameters, and applications of Electric Discharge Machining (EDM) and types, Laser Beam Machining (LBM), Electron Beam Machining (EBM), Chemical Vapour Deposition (CVD), Physical Vapour Deposition (PVD).	**07 Hrs.**
Unit 4	**Additive Manufacturing – Liquid based** Introduction, Traditional Vs. Rapid Prototyping (RP), Classification: Additive, Subtractive, Formative, Generic RP process, Data path – CAD model, slicing, G & M code. Stereo lithography Apparatus (SLA), Solid Object Ultraviolet-Laser Printer (SOUP), PolyJet 3D printing, MultiJet Printing (MJP), LIGA Process	**07 Hrs.**
Unit 5	**Additive Manufacturing – Solid & Powder based** Solid based- Fused deposition modeling (FDM), Selective Deposition Lamination (SDL), Laminated Object Manufacturing (LOM), Ultrasonic Consolidation Powder based - Selective Laser Sintering (SLS), Color Jet Printing (CJP), Laser Engineered Net Shaping (LENS), Electron Beam Melting (EBM)	**06 Hrs.**
Unit 6	**Manufacturing of Composite Materials** Fibers, Whiskers, Matrix, and Composites materials, Classification, Types of materials - Isotropic, Orthotropic, Anisotropic, Homogeneous and terminologies used, Various manufacturing processes - Hand lay-up, Bag Molding, Filament winding, Pultrusion, Resin transfer molding, Mechanical testing of composites- tensile, compressive, flexural, torsional, shear etc.	**06 Hrs.**

Course Contents: Laboratory

1. Part programming in CNC machine simulator.
2. Demonstration of composition analysis of the machined surface using modern techniques.
3. Demonstration of advancements in liquid, solid and powder based additive manufacturing processes.
4. Theoretical analysis of tensile strength of Fiber Reinforced Polymer (FRP) composites.
5. Preparation of FRP composite sheet using Hand Layup process.
6. Preparation of FRP composite pipe using Filament winding process..
7. Experimental analysis and validation of tensile strength of FRP composites..
8. Industrial visit to advanced machining center.

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Text Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
01	Manufacturing Technology- Foundry, Forming and Welding	P. N. Rao	Tata Mc- Graw Hill Publication	Second	2023
02	Foundry Technology	O. P. Khanna	Dhanpat Rai Publication	Fifteenth	2022
03	Production Technology: Vol. 1: Manufacturing Processes	P. C. Sharma	S. Chand	First	2022
04	Production Technology: Vol. 2: Machine Tools	P.C.Sharma	S. Chand	Second	2022
05	Workshop technology vol.1	S.K.Hajra Choudhary S.K.Bose	Media promoters and publishers pvt. ltd.	Twelfth	2021
06	Workshop technology vol.2 (Machine tools)	S.K.Hajra Choudhary S.K.Bose	Media promoters and publishers pvt. ltd.	Twelfth	2021

Reference Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
01	Materials and Processes in Manufacturing	E. Paul DeGarmo, J.T. Black.	PHI Publication	Eighth	2023
02	Mechanical Metallurgy	George E. Dieter	Tata Mc Graw Hill Publication	Third	2022
03	Machine Tools and Manufacturing Technology	Steve F. Krar, Mario Rapisarda.	Delmar publisher	Second	2022
04	Workshop Technology", Vol.I 2001, Vol. II 2007 and Vol. III 1995.	W.A.J.Chapman	CBS Publishing and Distributors, N. Delhi	Fifth	2021

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Course Details:

Class			T. Y. B. Tech. Sem.-VI
Course Code and Course Title			**2MEPE330, Metal Joining Process**
Domain			**Manufacturing**
Prerequisite/s			2MEPC214 Manufacturing Process
Teaching Scheme: Lecture/Tutorial/Practical			03/00/02
Credits			04
Evaluation Scheme	**T**	**ISE/MSE/ESE**	40/30/30
	P	**ISE/ESE**	25/0

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
2MEPE330_1	**Explain** the basic principle and concepts of metal joining processes.
2MEPE330_2	**Identify** different types of welding, brazing, soldering, and adhesive bonding techniques.
2MEPE330_3	**Analyse** the factors influencing the selection of appropriate metal joining processes for specific applications
2MEPE330_4	**Evaluate** the strengths, limitations, and applications of various metal joining processes.
2MEPE330_5	**Analyse** the strength and failure modes of different metal joining processes.

Course Contents: Theory		
Unit 1	**Introduction to Metal Joining Processes** Definition and importance of Joining processes, Classification of metal joining processes. Applications and significance in manufacturing industries, principles governing metal joining operations.	**06 Hrs.**
Unit 2	**Welding Processes** Basic principles, equipment, and applications of each welding method. Gas welding, arc welding, MIG, TIG welding. Resistance welding, Submerged arc welding	**07 Hrs.**
Unit 3	**Special welding processes:** Basic principles, equipment, and applications of Electron beam welding, Plasma arc welding, Laser welding, Ultrasonic welding, Diffusion bonding, Atomic hydrogen welding, Explosive welding.	**07 Hrs.**
Unit 4	**Brazing and Soldering** Principles, Applications and differences between brazing and soldering. Types of brazing (torch, furnace, induction) Fluxes and filler materials Soldering techniques (wave, reflow, iron)	**06 Hrs.**
Unit 5	**Adhesive Bonding** Introduction, Adhesive bonding as an alternative to traditional fusion-based joining methods. Types of adhesives (epoxy, cyanoacrylate, polyurethane) Surface preparation Application methods (brush, roller, spray) Curing and quality control, Different applications of Adhesive bonding	**06 Hrs.**

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Unit 6	**Riveting and bolting:** Types of bolts and their applications. Materials and grades of bolts. Standards and specifications (e.g., ISO, ASTM), Bolting Techniques and Tools Types of rivets and their applications. Materials and properties of rivets. Standards and specifications for rivets. Riveting Techniques and Tools. Comparison analysis of Bolting and Riveting	**07 Hrs.**

Course Content: Laboratory

1. Introduction to Welding Equipment and Safety Protocols:
2. Welding Techniques and Joint Preparation TIG
3. Welding Techniques and Joint Preparation MIG
4. Welding Techniques and Joint Preparation SAW
5. Demonstration of brazing techniques for joining metal components with suitable filler materials.
6. Demonstration of Soldering techniques for joining metal components
7. Demonstration of Adhesive Bonding Procedures
8. Demonstration of Bolting and Riveting of metal
9. Introduction to non-destructive testing (NDT) methods, including visual inspection, dye penetrant testing
10. Industrial visit

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Text Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	"Welding Principles and Applications"	Larry Jeffus	Cengage Learning	Eighth	2019
02	Welding Technology	N K Srinivasan	Khanna Publications	Fourth	2008
03	Brazing and Soldering	Richard D. Moyer	Crowood	Second	2014
04	Adhesive Bonding: Science, Technology, and Applications	Walter Brockmann	Wiley-VCH Verlag GmbH & Co.	First	2009

Reference Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Welding Technology	R. L. Little	Tata McGraw- Hill	First	2005
02	Introduction To Physical Metallurgy	Sidney H Avner	Mcgraw Hill education Pvt. Limited	second	1997
03	Fracture and Fatigue of Welded Joints and Structures	K Macdonald	Wood head Publishing	Fourth	2011
04	Brazing Handbook	American Welding Society	American Welding Society	Fifth	2011
05	Adhesive Bonding: Materials, applications and Technology	Sina Ebnesajjad	Elsevier	Third	2015

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DEPARTMENT OF MECHANICAL ENGINEERING

(Courses for Multiple Entry-Multiple Exits, Multidisciplinary and Specialized Minors, Honors and Research)

According to this curricular framework of the B. Tech Curriculum Structure in accordance with NEP2020, a complete set of courses for different learners to opt for : 1-Year UG Certificate, 2 Year UG Diploma in respective Major Programme and 3 Year B.Sc degree.

A. Courses for Minors

Totally 170 credits required to earn an undergraduate engineering degree which includes **Multidisciplinary Minor in Mechanical Engineering of 14 Credits.**

Course Code	Course Name	L	T	P	Credits
2MEIE201	Industrial Engineering	2			2
2MEIE301	Operations Research	3			3
2MEIE302	Supply Chain Management	3			3
2MEIE401	Total Quality Management	3			3
2MEIE451	Minor Project			3	3
Total		**11**		**3**	**14**

OR

Course Code	Course Name	L	T	P	Credits
2MEBM201	Engineering Materials	2			2
2MEBM301	Manufacturing Process	3			3
2MEBM302	Machines and Mechanisms	3			3
2MEBM401	Reliability Engineering	3			3
2MEBM451	Minor Project			3	3
Total		**11**		**3**	**14**

B. Courses for Double Minor (Specialization Minor)

An additional 14 credits required to earn under **Double Minor (Specialization Minor, Mechanical)** to get eligible for **Under Graduate** engineering **degree with Double Minor** .

Course Option	Credits	Platform
Geometrical Tolerances and Dimensions	2	--
Unigraphics/Creo/Solidworks Certification	3	Certification
ANSYS Multiphysics/ Hypermesh	3	Certification
FLUENT/Piping Design	3	Certification
Project	3	--
Total	**14**	

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Department of Mechanical Engineering

S. Y. B.Tech- (Mechanical Engineering)—Minor Stream Curriculum

Minor Stream II: Basic Mechanical

Class	SY B. Tech. Semester-IV
Course Code and Course Title	**2MEBM201 Engineering Materials**
Prerequisite/s	--
Teaching Scheme: Lecture/Tutorial	02/00
Credits	02
Evaluation Scheme: ISE/ MSE / ESE	20/15/15
Course Category	Employability

Course Outcomes (COs): Upon successful completion of this course, the students will be able to:	
2MEBM201_1	**Explain** classification of various materials according to their properties .
2MEBM201_2	**Classify** ferrous and non-ferrous materials in engineering applications using their compositions and properties.
2MEBM201_3	**Suggest** suitable material for a given engineering application
2MEBM201_4	**Select** appropriate heat treatment process for metals and alloys .
2MEBM201_5	**Illustrate** fundamentals of powder metallurgy processes for industrial applications through powder manufacturing processes.

Course Contents:		**Hrs.**
Unit 1	Plain carbon and alloy steels- Structural steels, Tool steels, stainless steel. Aluminum and copper alloys. Designation as per BIS, equivalent international names, properties, Heat treatment of steels. Standard dimensions of structural steels, plates, bars. Aluminum structural members. Welding rods ,their composition and technical designations	**06**
Unit 2	**Sintered Materials**-Manufacturing of metal powder, Sintering process, Mechanical properties of sintered materials, Heat treatment of sintered material **Surface coating materials**-Metal spraying, Surface coating techniques-Electroplating, Vapor deposition coating, Powder coating **Engineering ceramics and Refractory materials –**Physical and mechanical properties of engineering ceramics, Aluminous cements, castable materials, applications of ceramics and refractory materials **Magnetic materials and properties**-Alnico alloys, Ferrite and rare earth alloys, Neodymium iron boron as magnetic material. Process of magnet manufacturing	**07**
Unit 3	**Polymers and fiber reinforced plastics-** Type of plastics and their properties and applications. Polymers as bearing material, Polymers and fiber reinforced plastics(FRP), manufacturing of FRP,	**06**

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	Properties and applications of FRP **Rubbers**-Types, properties and applications **Metallic foams**-properties and applications	
Unit 4	**Smart materials**-Electro-rheological fluids, Magneto-rheological fluids and their properties, Piezo electrical materials and its properties, Shape memory alloys and properties, Fiber optic sensors Thermal insulation materials, properties. applications Electric Insulation material, properties, applications Sound absorbing materials, properties, applications Radiation preventive material, properties, applications Packing materials, properties, applications Nano materials, properties , applications	**07**

Text Books:

Title	Author	Publisher	Edition	Year of Edition
Material science and metallurgy for engineers	V.D. Kodgire	Everest Publishers Pune	Twelth	2009
Introduction to physical metallurgy	S.H.Avner	McGraw Hill Book Company Inc	Second	1988
Engineering Metallurgy Part-I	R. A. Higgins	ELBS with Edward Arnold	Sixth	1994
Material Science and Engineering	V Raghwan	Prentice Hall of India Pvt. Ltd., New Delhi	Third	1995

Reference Books:

Title	Author	Publisher	Edition	Year of Edition
Material science and Engineering	Ralls, Courtney and Wulff	Wiley India Pvt. Ltd	Second	2011
Smart materials and structures	M.V.Gandhi and B.S.Thompson	Chapman &Hall	first	1992

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ANNASAHEB DANGE COLLEGE OF ENGINEERING AND TECHNOLOGY, ASHTA
(An Autonomous Institute)
Department of Mechanical Engineering
T.Y. B.Tech- (Mechanical Engineering)—Second Revision

Course Details:

Class			T. Y. B. Tech. Semester- V
Course Code and Course Title			**2MEBM301, Manufacturing Process**
Prerequisite/s			--
Teaching Scheme: Lecture/Tutorial/Practical			03/00/00
Credits			03
Evaluation Scheme	**T**	**ISE/MSE/ESE**	40/30/30
	P	**ISE/ESE**	00/00

Course Outcomes (COs): After successful completion of this course, the student will be able to:	
2MEBM301_1	Explain the working and elements of different casting processes to produce the work using basic principle of various casting process like sandcasting, permanent mould casting.
2MEBM301_2	Interpret the working of forming and plastic moulding processes to produce different shaped components with method of operation of these processes.
2MEBM301_3	Differentiate between various metal joining processes on the basis of working and elements used in joining processes like welding, soldering and brazing, riveted and bolted joints.
2MEBM301_4	Choose the modern manufacturing methods to cut metals, glass, plastic by using the basic principle, mechanism and components of non-conventional machining processes.
2MEBM301_5	Select the manufacturing process to produce the various components required in industry using the fundamental knowledge of different manufacturing processes.

Course Contents: Theory		
Unit 1	**Introduction to manufacturing processes and Fundamentals of Casting** Introduction and classification of manufacturing processes, Importance of casting, advantages, disadvantages and limitations of casting, introduction and types of patterns and core boxes/Moulding and core processes: Types of sands used in moulding and core making, their properties. Sand moulding types such as green sand Moulding, shell Moulding, Investment casting.	**07 Hrs**
Unit 2	**Casting Processes** Introduction to permanent mould casting processes such as Continuous casting, Gravity die casting, pressure die-casting, Centrifugal casting, Vacuum die casting, Squeeze casting, Introduction to Additive manufacturing processes for mould making.	**07 Hrs**

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Unit 3	**Forming Processes** Various metal forming operations, hot and cold working of metals such as forging, rolling, extrusion, wire drawing, sheet metal working, spinning, swaging, thread rolling, metal forming defects etc.	**06 Hrs**
Unit 4	**Plastic Moulding** Blow moulding, compression moulding, transfer moulding, injection moulding, extrusion, thermoforming, rotational moulding, foam moulding and calendaring etc.	**06 Hrs**
Unit 5	**Joining Processes** Overview and classification of joining processes, Surface preparation and various joints, Arc Welding- SMAW, TIG, MIG, Resistance welding- Spot, Seam and Projection welding process, Soldering and Brazing, riveted and bolted joints. Introduction to inspection techniques to inspect the welding joints.	**07 Hrs**
Unit 6	**Nonconventional machining processes** Need of nonconventional machining, Electro-chemical, electro-discharge, ultrasonic, LASER, electron beam, water jet machining. Introduction to Various Software used for different Manufacturing Processes.	**06 Hrs**

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Manufacturing Technology- Foundry, Forming and Welding	P. N. Rao	Tata Mc- Graw Hill Publication	Second	2009
02	Foundry Technology	O. P. Khanna	Dhanpat Rai Publication	Fifteenth	2011
03	Production Technology: Vol. 1: Manufacturing Processes	P. C. Sharma	S. Chand	First	2006
04	Production Technology: Vol. 2: Machine Tools	P.C.Sharma	S. Chand	Second	2006
05	Workshop technology vol.1	S.K.Hajra Choudhary S.K.Bose	Media promoters and publishers pvt ltd.	Twelfth	2012
06	Workshop technology vol.2 (Machine tools)	S.K.Hajra Choudhary S.K.Bose	Media promoters and publishers pvt ltd.	Twelfth	2012
07	Workshop Technology vol. II,	B.S. Raghuvanshi	Dhanpat Rai and Sons.	Sixth	2015

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Reference Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Materials and Processes in Manufacturing	E. Paul DeGarmo, J.T. Black.	PHI Publication	Eighth	1997
02	Mechanical Metallurgy	George E. Dieter	Tata Mc Graw Hill Publication	Third	2013
03	Machine Tools and Manufacturing Technology	Steve F. Krar, Mario Rapisarda.	Delmar publisher	Second	2010
04	Workshop Technology", Vol.I 2001, Vol.II 2007 andVol.III 1995.	W.A.J.Chapman	CBS Publishing and Distributors, N. Delhi	Fifth	2001

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Course Details:

Class			T.Y. B. Tech. Sem. - VI
Course Code and Course Title			**2MEBM302,Machines and Mechanism**
Prerequisite/s			---
Teaching Scheme: Lecture/Tutorial/Practical			03 /00/00
Credits			03
Evaluation Scheme	**T**	**ISE/MSE/ESE**	40/30/30
	P	**ISE/ESE**	00/00

Course Objectives: The course aims:	
01	To demonstrate the working principles of brakes and clutches.
02	To explain various power transmitting devicesand their applications.
03	To provide knowledge of cams and followers with their applications.
04	To explain terminology of gears and characteristics of governors.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
1MEBM302_1	**Explain** the terminology associated with different mechanisms, belts drives, gears, brakes & clutches, cam, governor using theory of kinematics.
1MEBM302_2	**Distinguish**betweenbelt drivesand gear drives according to their applications.
1MEBM302_3	**Compute** different parameters related to power transmitting devices, brakes, clutches, governor, cam and follower using analytical or graphical approaches.
1MEBM302_4	**Select** the appropriate mechanism , power transmitting devices for a particular application based on its kinematic analysis.
1MEBM302_5	**Illustrate** the working principle of brakes and clutches using theory of friction.

Course Contents: Theory		
Unit 1	**Fundamentals of Mechanisms:** Link, Kinematic pair, Kinematic chain, Mechanism, Inversions, Types of constrained motions, Grubbler's criterion, Grashof's criterion for mobility, Kutzbach criterion, Four bar chain and its inversions, Slider crank chain and its inversions, Double slider crank chain and its inversions	**06 Hrs.**
Unit 2	**Gears:** Classification of gears, Spur Gears - terminology, fundamental law of toothed gearing, involutes and cycloidal profile, contact ratio, minimum number of teeth, interference and under cutting.	**07 Hrs**
Unit 3	**Belt Drives:** Types of belt drives, Calculation of power transmitted, Belt tension ratio, Actual tension in a running belt, Centrifugal and initial tension in belt, Slip	**06Hrs.**

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	and creep of belt, V Belts, Selection of Belts. [Numerical Treatment on flat belt only]	
Unit 4	**Brakes & Clutches:** **Brakes:** Introduction, material for brake lining, types of brakes, single & double block or shoe brake, pivoted block or shoe brake, simple band brake, differential band brake, band and block brake, internal expanding brake, disc brakes. **Clutches:** Introduction, friction clutch, single disc or plate clutch, multiple disc clutch, cone clutch, centrifugal clutch.	**07 Hrs.**
Unit 5	**Cams and Followers:** Classification of cams. Classification of followers, Terminologies of cam and follower, Motions of Follower a) Uniform velocity b) Simple harmonic motion c) Uniform acceleration and retardation d) Cycloidal motions, Displacement diagram of follower, Velocity and acceleration diagram of Follower, Construction of cam profile	**07 Hrs.**
Unit 6	**Governors:** Comparison between governors and flywheel. Types-centrifugal governors, inertia governors. Force analysis - gravity loaded governors-Porter type, Spring loaded governors-Hartnell type, Applications of governors.	**06 Hrs.**

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Theory of Machines	Ratan S.S	Tata McGraw Hill New Delhi.	Third	13th reprint 2012
02	Theory of Machines	P.L.Ballany	Khanna Publication, New Delhi	Twenty fifth	2012
03	Theory of Machines	V.P. Singh	Dhanpat Rai and Sons	Third	2012
04	Kinematics & Dynamics of Machines	George Martin	Waveland Press, Inc.	Second	2002

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Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Theory of Machines	Thomas Bevan	CBS Publishers, New Delhi.	Third	reprint 2005
02	Theory of Machines and Mechanism	Shigley	Oxford International	Third	2009
03	Theory of mechanism and machines	Sadhu Singh	Pearson	First	2012
04	Theory of machines and Mechanism	JagdishLal	Metropolitin Book Company	First	2011
05	Mechanism and Machines	Gosh And Mallik	East West Press	Third	1998
06	Theory of Machine	Sarkar	Tata McGraw Hill	First	2002

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Department of Mechanical Engineering
B.Tech- (Mechanical Engineering)—Minor Stream Curriculum

Course Details:

Class	B. Tech, Sem.- VII
Course Code and Course Title	**2MEBM401, Reliability Engineering**
Prerequisite/s	--
Teaching Scheme: Lecture/Tutorial	03/00
Credits	03
Evaluation Scheme: ISE/ MSE / ESE	40/30/30
Course Category	Skill Development/Employability

Course Outcomes (COs): After successful completion of this course, the student will be able to:	
2MEBM401_1	**Explain** reliability and maintainability engineering considerations as applied to engineering systems, demonstrating proficiency in using diverse models and techniques.
2MEBM401_2	**Apply** reliability engineering principles to analyze, model, and evaluate the performance of engineering systems using various reliability measures and models.
2MEBM401_3	**Analyze** the reliability, availability, and maintainability of engineering systems using appropriate techniques and models.
2MEBM401_4	**Incorporate** reliability and maintainability considerations into engineering designs, using tools such as Fault Tree Analysis and Failure Modes, Effects, and Criticality Analysis to optimize system performance.
2MEBM401_5	**Evaluate** the economic implications of reliability and maintainability decisions throughout the product life cycle, integrating testing and growth strategies for continuous improvement.

Syllabus:

Course Contents:		**Hrs.**
Unit 1	**Introduction:** Overview of reliability engineering and its significance, Basic concepts and definitions, History and applications, Reliability vs. availability vs. maintainability, Different approaches, Concept of failure, Failure classification, Failure mechanisms, Failure modes, Engineering failures and their causes, Concept of random events and random variables, Rules of probability theory, Discrete and continuous probability distributions.	**07**
Unit 2	**Reliability Measures:** Reliability function–R(t), cumulative distribution function (CDF)–F(t), probability density function (PDF) – f(t), hazard rate function-λ(t), Mean time to failure (MTTF) and Mean time between failures(MTBF), median time to failure (t_{med}), mode (t_{mode}), variance (σ^2) and standard deviation (σ), typical forms of hazard rate function and bathtub curve.	**06**

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Unit 3	**Basic Reliability Models:** Constant failure rate (CFR)/Exponential model, Estimation of R(t), F(t), f(t), λ(t), MTTF, t_{med}, t_{mode}, σ^2 and σ for CFR model, Weibull distributions, Estimation of R(t), F(t), f(t), λ(t), MTTF, t_{med}, t_{mode}, σ^2 and σ for Weibull distribution, Application of CFR model and Weibull model to typical engineering systems (Numericals).	**06**
Unit 4	**Reliability Evaluation of Systems:** Reliability evaluation techniques, series configuration, parallel configuration, mixed configurations, redundant systems, high level versus low level redundancy, k-out-of-n redundancy, complex configurations, network reduction and decomposition methods.	**07**
Unit 5	**Maintainability and Availability:** Concept of maintainability, quantification of maintainability, measures of maintainability, analysis of downtime, maintenance concept and procedures, maintenance task, maintenance policies, maintenance resources and maintenance costs. Availability concepts and definitions, important availability measures.	**07**
Unit 6	**Design for Reliability and Maintainability:** Fault tree analysis technique, failure modes, effects and criticality analysis (FMECA), FMECA steps, reliability and maintainability design process, reliability activities and product life cycle, economic analysis and product life cycle costs, reliability testing, reliability growth testing and reliability growth cycle.	**06**

Reference Books

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Practical Reliability Engineering	Patrick D.T. O'Conner, David Newton, Richard Bromley	John Wiley and Sons.	First	2002
02	Reliability Engineering: Theory and Practice	Alessandro Birolini	Springer	First	2010
03	Reliability Engineering: Probabilistic Models and Maintenance Methods	Joel A. Nachlas	Taylor and Francis	--	2005
04	Case studies in Reliability and Maintenance	W. R. Blischke, D.N.P. Murthy	John Wiley and Sons	Second	2003

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Text Books

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	An Introduction to Reliability and Maintainability Engineering	Charles E. Ebling	Waveland Press	Third	2019
02	Reliability Engineering	L. S. Srinath	East West Press, New Delhi	Fourth	2005
03	Engineering Reliability – New Techniques and Applications	B. S. Dhillon, Chanan Singh	John Wiley and Sons	First	1981
04	Engineering Maintainability	B. S. Dhillon,	Prentice Hall of India	--	1999

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Department of Mechanical Engineering

S. Y. B.Tech- (Mechanical Engineering)—Minor Stream Curriculum

Course Details:

Class	SY-B. Tech. Semester-IV-VII
Course Code and Course Title	**2MEBM451Minor project**
Prerequisite/s	--
Teaching Scheme: Practical	03
Credits	03
Evaluation Scheme: ISE / ESE	**50/50**
Course Category	Skill development/Employability/Entrepreneurship

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
2MEIE451_1	**Identify** the real life institutional or industrial problem relevant to the societal, health & environmental issues for sustainable development.
2MEIE451_2	**Formulate**, **analyze** complex engineering problems and give cost-effective optimal solution.
2MEIE451_3	**Design** of components, system or processes that meet the specified needs by using advance tools/ techniques/ resources.
2MEIE451_4	**Interpret** the impact of solution by considering environmental issues, societal aspects like health, safety etc.
2MEIE451_5	**Apply** the engineering and management principles to manage projects maintaining professional and ethical principles as an individual or as a team.
2MEIE451_6	**Prepare** the design reports and make effective presentations on complex engineering activities.

Course contents:

- Minor project work can be a design project / experimental project and /or computer simulation project on mechanical engineering or any of the topics related with industrial engineering stream.
- Minor project can be consists of problem identification, literature review, formulation of problem, design of components/system/ process, modern tools used in the project.
- Submission of synopsis of selected project work. Synopsis report should highlight scope, objectives, methodology, approach and tools to be used like software, other expected results and outcomes along with time frame.
- One copy of the synopsis report should be expected to submit to project guide and one copy should remain with project group.
- Minor project work is divided in four semesters, to be extended with same group working under guidance of same project guide assigned for Project.

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Project work submitted by students shall include;

- The group of students (2 to 5) have to complete the minor project as follows:

Semester	Work to be completed	Assessment
IV	Literature review (Review Paper) and synopsis Presentation	Review-I
V	Methodology/Design	Review-II
VI	Complete Setup/Fabrication/Assembly	Review-III
VII	Testing, Report Writing, Paper Publication	Review-IV

- The report of the work completed in the form of project work diary, Minor project report and other relevant documents shall be submitted for the term work. The term work shall be assessed by the project guide and the assessment shall be based on a presentation of the work completed and submission of report.
- ***Work Diary*:** Work Diary maintained by group & countersigned by guide weekly. The contents of work diary shall reflect the efforts taken by project group for
- Searching suitable project work
- Brief report preferably on journals/ research or conference papers/ books or literature surveyed to select and bring up the project.
- Day to day activities carried out related to project work for entire semester.
- ***Synopsis report*:** The group should submit the synopsis in following prescribed format.
- Title of Project
- Names of Students
- Name of Guide
- Relevance
- Literature review
- Proposed work
- Methodology
- Expected outcomes
- Plan of proposed work
- Detailed Budget Estimate
- References

  *Synopsis should consist of minimum **eight** review papers and shall be signed by the each student in the group, approved by the guide and endorsed by the Head of the Department.*
- ***Minor project report*:** Report should be of 25 to 30 pages (typed on A4 size sheets). For standardization of the Minor project reports the following format should be strictly followed.
- Page Size: Trimmed A4
- Top Margin: 1.00 Inch
- Bottom Margin: 1.32 Inches
- Left Margin: 1.5 Inches
- Right Margin: 1.0 Inch
- Para Text: Times New Roman 12 Point Font

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- Line Spacing: 1.5 Lines
- Page Numbers: Right Aligned at Footer. Font 12 Point. Times New Roman
- Headings: Times New Roman, 14 Point , Bold Face
- References: References should have the following format
- For Papers: *Authors, "Title of Paper",Publisher Details,Volume,Year,Page no*
- For Books: *Authors, "Title of Book", Publisher, Edition, page nos.*

Presentation of work

The student has to make a presentation in front of the faculty members and review panel member at the time of review's and submit presentation soft copy to project guide.

Important Notes:

- Project group should continue maintaining a work diary for project and should write (a) Book referred (b) Company visited (c) Person contacted (d) Paper referred (e) Creative thinking.
- Work diary along with Project report shall be assessed at the time of ESE examination

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DEPARTMENT OF MECHANICAL ENGINEERING

(Courses for Multiple Entry-Multiple Exits, Multidisciplinary and Specialized Minors, Honors and Research)

According to this curricular framework of the B. Tech Curriculum Structure in accordance with NEP2020, a complete set of courses for different learners to opt for : 1-Year UG Certificate, 2 Year UG Diploma in respective Major Programme and 3 Year B.Sc degree.

A. Courses for Minors

Totally 170 credits required to earn an undergraduate engineering degree which includes **Multidisciplinary Minor in Mechanical Engineering of 14 Credits.**

Course Code	Course Name	L	T	P	Credits
2MEIE201	Industrial Engineering	2			2
2MEIE301	Operations Research	3			3
2MEIE302	Supply Chain Management	3			3
2MEIE401	Total Quality Management	3			3
2MEIE451	Minor Project			3	3
Total		**11**		**3**	**14**

OR

Course Code	Course Name	L	T	P	Credits
2MEBM201	Engineering Materials	2			2
2MEBM301	Manufacturing Process	3			3
2MEBM302	Machines and Mechanisms	3			3
2MEBM401	Reliability Engineering	3			3
2MEBM451	Minor Project			3	3
Total		**11**		**3**	**14**

B. Courses for Double Minor (Specialization Minor)

An additional 14 credits required to earn under **Double Minor (Specialization Minor, Mechanical)** to get eligible for **Under Graduate** engineering **degree with Double Minor** .

Course Option	Credits	Platform
Geometrical Tolerances and Dimensions	2	--
Unigraphics/Creo/Solidworks Certification	3	Certification
ANSYS Multiphysics/ Hypermesh	3	Certification
FLUENT/Piping Design	3	Certification
Project	3	--
Total	**14**	

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Minor Stream I: Industrial System Engineering

Course Details:

Class	S. Y. B. Tech. Semester-IV
Course Code and Course Title	**2MEIE201, Industrial Engineering**
Prerequisite/s	---
Teaching Scheme: Lecture/Tutorial	02/00
Credits	02
Evaluation Scheme: ISE/ MSE / ESE	20/15/15
Course Category	Employability

Course Outcomes (COs): After successful completion of this course, the student will be able to:	
2MEIE201_1	**Apply** the fundamentals of industrial engineering for a given industrial production scenario to calculate and improve productivity using appropriate tools and techniques.
2MEIE201_2	**Prepare** the records of various industrial tasks and operations using appropriate charts and diagrams.
2MEIE201_3	**Estimate** the normal time and standard time for industrial work and activities using appropriate work measurement techniques.
2MEIE201_4	**Identify** optimum sequence and schedule of number of jobs on number machines using appropriate sequencing and scheduling technique.
2MEIE201_5	**Estimate** the project duration and inventory level for timely completion of project and uninterrupted production using project appropriate project management and inventory control techniques.

Syllabus:

Course Contents:		**Hrs**
Unit 1	**Industrial Engineering and Productivity** Scope, Role of industrial engineer, tools and techniques of industrial engineering, Productivity- concept, objective, factors affecting productivity, tools & techniques to improve productivity, value analysis & value engineering. (Numerical treatment on productivity measures).	**05**
Unit 2	**Lean manufacturing** JIT, SMED, 5S, Kaizen, Six Sigma, Kanban, Management Information System, Total productive maintenance, Poka-Yoke.	**04**
Unit 3	**Method Study** Objectives of method study, various recording techniques, therblings, micro-motion study, MEMO motion study, principles of motion economy. (Exercises on recording	**04**

	techniques)	
Unit 4	**Work Measurement** Definitions, objectives, activity and elements, performance rating, rating methods, allowances, work sampling, predetermined motion time system, workplace ergonomics. (Numerical treatment on performance rating, normal and standard time calculations)	**05**
Unit 5	**Capacity and aggregate planning and scheduling of operations** Introduction, measures of capacity, capacity strategies, overcapacity & under capacity factors. Aggregate planning, Aggregate planning strategies. Sequencing problems, n jobs 1 Machine, n jobs 2 Machines, n jobs 3 Machines. (Numerical treatment)	**04**
Unit 6	**Inventory Control and Network Techniques** Inventory valuation by LIFO and FIFO, ABC analysis, network techniques, critical path method, forward & backward scheduling. (Numerical treatment on critical path method).	**04**

Reference Books

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
01	Industrial Engineering and Management	Khanna O. P.	Dhanpat Rai Publications(P) Ltd, New Delhi	Revised	2003
02	Industrial Engineering and Production Management	Martand Telsang	S. Chand & Company Ltd., New Delhi	Revised	2006
03	Global Management Solutions Demystified	Dinesh Seth, Subhash Rastogi	Cengage learning publications.	Second	2009
04	Industrial Engineering Handbook	H.B. Maynard and Others	Tata McGraw Hill Publication	Fourth	2009

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Text Books

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Hand Book of Industrial Engineering	Gavrial Salvendy	John Wiley and Sons, New York,	--	2007
02	Industrial Engineering	M. I. Khan	New age international(P) Ltd, New Delhi	Reprint	2004
03	Introduction To Work Study	International Labour Office	International Labour Office,1969	Digitalized	2008
04	Operations research	D.S.Hira and Gupta	Chand & Co. New Delhi.	Seventh	1976

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T. Y. B.Tech- (Mechanical Engineering)—Minor Stream Curriculum

Course Details:

Class			T. Y. B. Tech. Semester- V
Course Code and Course Title			**2MEIE301, Operations research**
Prerequisite/s			--
Teaching Scheme: Lecture/Tutorial/Practical			03/00/00
Credits			03
Evaluation Scheme	**T**	**ISE/MSE/ESE**	40/30/30
	P	**ISE/ESE**	00/00

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
2MEIE301_1	**Formulate** linear programming problems for various operations research (OR) models, demonstrating proficiency in problem-solving techniques
2MEIE301_2	**Solve** various types of problems related to Assignment and Transportation models of Operational Management using relevant model procedures.
2MEIE301_3	**Compute** various types of problems of decision, Replacement and Queuing theory models of Operational Management using relevant model procedures.
2MEIE301_4	**Construct** network diagrams and determine critical path, floats for project management purposes using both deterministic and PERT techniques.
2MEIE301_5	**Solve** the problems of central tendency of measures with adherence to statistical principles with appropriate data collection and analysis techniques.

Course Contents: Theory		
Unit 1	**Introduction to OR and Linear Programming Problems Introduction** History and development of OR, Applications, modelling in OR, OR models and their applications. Linear Programming Problems: Formulation of problem, Graphical solution, Simplex procedure for maximization and minimization, Big M Method (Only theoretical treatment), Duality concept.	**07 Hrs**
Unit 2	**Assignment Model and Transportation Model Assignment Model** Mathematical statement, Methods to solve balanced and unbalanced assignment problems, Maximization problems, Assignment with restrictions, Traveling salesman problem. Transportation Model: Mathematical formulation, methods to obtain initial basic feasible solution (IBFS), NWCR, Least Cost and VAM, Conditions for testing optimality, MODI method for testing optimality solution of balanced and unbalanced problems,	**06 Hrs**

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Unit 3	**Decision Theory** Introduction, Pay off table, Opportunity loss or regret table, Decisions under uncertainty, Laplace criterion, Maximin or Minimax principle, Maximax or Minimin principle, Hurwicz principle, Decisions under risk–maximum likelihood criteria, Expectation principle, Expected opportunity loss, decision trees.	**07 Hrs**
Unit 4	**Project Management** Introduction to PERT and CPM, critical Path calculation, float calculation and itsimportance. Replacement theory: Computation **Sequencing**: Sequencing of n jobs on two machines, n jobs on three machines, n job m machines	**07 Hrs**
Unit 5	**Replacement theory** Need, Replacement of items whose maintenance cost increases with time (with and without considering time value of money), Replacement of items that fail suddenly. **Queueing Systems** General concepts of a queueing system, measures of performance, arrival and service processes, single and multiple server models, channels in parallel and in series with limited and unlimited queues, Little's formula, Queues with finite waiting room, Queues with impatient customer(Balking and reneging)	**05 Hrs**
Unit 6	**Data Analysis** Data Collection: sources and methods of data collection, questionnaire design, sampling sample size, sampling distribution, methods of sampling, sampling errors. Data Analysis: Pictorial representation-Cross tabulation, Bar Chart, Pei Chart, Histogram etc. Numerical calculation-Measures of Central Tendency-mean, median, mode, quartiles, deciles and percentiles. Measures of Dispersions- range, mean deviation, quartile deviation and standard deviation. Correlation, Regression.	**07 Hrs**

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Department of Mechanical Engineering

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Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Business Management	J.P. Bose, S. Talukdar	New Central Agencies (P) Ltd., Delhi	Third	2010
02	Operation Research	J.K. Sharma	McMillan India Publication, Delhi	Eighth	2011
03	Operations Research	ManoharMahajan	Dhanapat Rai And Sons,Delhi	Eighth	2009
04	Production and operation management	S.N.Chary	Tata McGraw hill Delhi	Fifth	2015

Reference Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
01	Introduction to Operation Research	Hamdy A. Taha	Prentice Hall India Publication, New Delhi	Eighth	2011
02	Operations Research	D.S. Hira& P.K. Gupta	S. Chand & Co., New Delhi	Fifth	2011
03	Industrial Engineering and Production Management	M.T.Telsang	S. Chand & Co., NewDelhi	Fourth	2013
04	Production and operation management	R.B.Khanna	PHI	Second	2015

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ANNASAHEB DANGE COLLEGE OF ENGINEERING AND TECHNOLOGY, ASHTA
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Department of Mechanical Engineering
T.Y. B.Tech- (Mechanical Engineering)—Second Revision

Course Details:

Class			T. Y. B. Tech. Semester- VI
Course Code and Course Title			**2MEIE302, Supply Chain Management**
Prerequisite/s			--
Teaching Scheme: Lecture/Tutorial/Practical			03/00/00
Credits			03
Evaluation Scheme	**T**	**ISE/MSE/ESE**	40/30/30
	P	**ISE/ESE**	00/00

Course Outcomes (COs): After successful completion of this course, the student will be able to:	
2MEIE302_1	**Explain** the basics of Logistics and Supply Chain and their role in today's business environment by using Logistics and Supply Chain Management concepts.
2MEIE302_2	**Identify** the various drivers of supply chain performance and risks in supply chain management with performance measurement methods.
2MEIE302_3	**Apply** various techniques to rank the items of inventory management using inventory management technique.
2MEIE302_4	**Apply** various strategies and techniques to minimize overall logistics cost using logistics cost reduction techniques.
2MEIE302_5	Design the supply chain network for various distribution networks using mathematical models and tools.

Course Contents: Theory		
Unit 1	**Introduction:** Objectives of a Supply Chain Management, Stages of Supply chain, Value Chain Process, Cycle view of Supply Chain Process, Key issues in SCM, logistics & SCM, Supply Chain Drivers /decisions and obstacles, Supply chain strategies, strategic fit, Best practices in SCM, Obstacles of streamlined SCM, Make & Buy Decision.	**06 Hrs**
Unit 2	**Supply Chain Performance:** Performance measurement: Dimension, Tools of performance measurement, SCOR Model. Demand chain management, Global Supply chain- Challenges in establishing Global Supply Chain, Factors that influences designing Global Supply Chain Network. Supply Chain Risk Management (Risks involved in supply chain which includes – Supplier Financial Risk, Performance Risk, Compliance Risk, Country specific Risk, Cyber Security.	**07 Hrs**
Unit 3	**Inventory management:** Definition of Inventory, Inventory types & functions; EOQ Model and Buffer Stock, Assumptions, Instantaneous Replenishment case, Demand and production rate are different, when backorders are allowed, Buffer Stock and ROL. Replenishment systems (Q and P system) Inventory Control- ABC Analysis.	**07 Hrs**

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Unit 4	**Logistics Management and outsourcing:** Objectives, Components and Functions of Logistics Management, Distribution related Issues and Challenges; Gaining competitive advantage through Logistics Management, Transportation- Functions, Costs, and Mode; Network and Decision, Containerization, Cross docking. Warehousing: Concept and types, Reverse logistics: Outsourcing - Nature and concept, Strategic decision to Outsourcing, Third party logistics(3PL), Fourth party logistics(4PL).	**07 Hrs**
Unit 5	**Digitization in supply chain Management and Sustainability:** IT in supply chain - Role of IT in a supply chain, The supply chain IT framework, Application of Bar coding, Significance of SAP/RFID, The future of IT in the supply chain, Supply chain IT in practice, TMS (Transport Management System), WMS (Warehouse Management System) ,Green supply chain management, Social aspects of supply chain (CSR), Environment aspects of supply chain, resource utilization, recycling. Introduction to simulation tools like sales force and AI, ecommerce methods.	**06 Hrs**
Unit 6	**Supply Chain Network Design:** Factors influencing distribution network design, Supply chain resilience, Design options for distribution network, Introduction to mathematical modelling, considerations in modelling SCM systems, Transportation problem. Value Stream Mapping (VSM), Order Fulfillment Process Flow, understanding the terms related to Supply chain- Lead Time, Takt Time , Minimum Order Quantity (MOQ).	**06 Hrs**

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Manufacturing Technology- Foundry, Forming and Welding	P. N. Rao	Tata Mc- Graw Hill Publication	Second	2009
02	Foundry Technology	O. P. Khanna	Dhanpat Rai Publication	Fifteenth	2011
03	Production Technology: Vol. 1: Manufacturing Processes	P. C. Sharma	S. Chand	First	2006
04	Production Technology: Vol. 2: Machine Tools	P.C.Sharma	S. Chand	Second	2006
05	Workshop technology vol.1	S.K.Hajra Choudhary S.K.Bose	Media promoters and publishers pvt ltd.	Twelfth	2012
06	Workshop technology vol.2 (Machine tools)	S.K.Hajra Choudhary S.K.Bose	Media promoters and publishers pvt ltd.	Twelfth	2012

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07	Workshop Technology vol. II,	B.S. Raghuvanshi	Dhanpat Rai and Sons.	Sixth	2015

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Materials and Processes in Manufacturing	E. Paul DeGarmo, J.T. Black.	PHI Publication	Eighth	1997
02	Mechanical Metallurgy	George E. Dieter	Tata Mc Graw Hill Publication	Third	2013
03	Machine Tools and Manufacturing Technology	Steve F. Krar, Mario Rapisarda.	Delmar publisher	Second	2010
04	Workshop Technology", Vol.I 2001, Vol.II 2007 andVol.III 1995.	W.A.J.Chapman	CBS Publishing and Distributors, N. Delhi	Fifth	2001

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ANNASAHEB DANGE COLLEGE OF ENGINEERING AND TECHNOLOGY, ASHTA
(An Autonomous Institute)

Department of Mechanical Engineering

B.Tech- (Mechanical Engineering)—Minor Stream Curriculum

Course Details:

Class	B. Tech, Sem.-VII
Course Code and Course Title	**2MEIE401 Total Quality Management**
Prerequisite/s	--
Teaching Scheme: Lecture / Tutorial	03/00
Credits	03
Evaluation Scheme: ISE/ MSE / ESE	40/30/30
Course Category	Skill development/Employability

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
2MEIE401_1	**Explain** the techniques and philosophy of Total Quality Management using TQM principles.
2MEIE401_2	**Apply** statistical process control techniques to control the quality of the process with relevant controlling techniques**.**
2MEIE401_3	**Identify** the system reliability using different tests to find the loss functions.
2MEIE401_4	**Classify** different customers, organizational structures and their role and responsibilities using principles of TQM.
2MEIE401_5	**Select** an appropriate quality certification like ISO series of standards with its importance to implement total quality management in industries.

Course Contents:		**Hrs.**
Unit 1	**Quality Assurance System:** Concept of total quality, role and objectives of quality assurance, quality assurance cycle, process approach to quality assurance (input-process-output), information feedback, Significance of feedback and field complaints analysis in quality assurance, significance of internal customer approach in defect prevention program for quality assurance.	**06**
Unit 2	**Planning Techniques for Quality** Planning for Quality: The dimensions of Quality (quality of Design, conformance, performance and service) Specifications of quality dimensions, quality planning activities for new products, Advanced Product Quality Planning (APQP, Vendor rating). **Controlling Techniques for Quality**: SPC, Problem solving QC tools, Process capability analysis, Six sigma- concept, need, implementation, DPMO, Gradation.	**07**

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Unit 3	**Robust and Reliable product approach for Quality:** Product and System reliability, Basic concepts, Prediction and evaluation of parallel, series and combined system reliability, Reliability tests (life testing, burn-in test, accelerated life testing) FMEA and FTA Introduction to design of experiments.	**07**
Unit 4	**Principles and Approaches to TQM:** Basic Concepts: Concept and definition of TQM, TQM and traditional management approach, Principles, Models (TQM pyramid – Okland, Integrated model-shoal), building blocks of TQM-Zaire, the house of TQM-Kano), Characteristics and benefits of TQM. Approaches to TQM: Deming's approach, Juran's triology, Crosby and quality improvement, Ishikawa's CWQC, Feignbaum's theory of TQC, Schnberger's action agenda for manufacturing excellence.	**07**
Unit 5	**Essentials of TQM:** **Customer focus-** Customer perception of quality, Customer satisfaction, Kano's model of satisfaction, Customer retention. **TQM leadership** - role and commitment and accountability of leadership, Quality policy and objectives, Organizational structure for TQM, Role of HR in TQM, Training for TQM, Developing quality culture. **Tools and Techniques for TQM** 5-S campaign, TEI, Quality circles, QFD, FMEA and FTA, Poka-yoke, Kaizen.	**08**
Unit 6	**Current trends in TQM** **TQM in Service Sector**: Definition and meaning of service, Problems in defining service quality, Attributes of service quality, SERVQUAL model, Implementing TQM in service industries, Measurement system for service quality. **Quality Management Systems:** ISO 9001:2008 Series of Standards Structure of ISO 9001:2008 series standards, Clauses, Contents, Interpretation and Implementation, Audit Sector specific Standards: AS 9100, ISO/TS 16949, TL 9000, Quality awards: national and international quality awards, criteria and case studies.	**07**

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Text Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Total Quality Management	Dale H. Bester filed	Pearson Education Asia	Third	2012
02	Industrial Engineering and Production Management	Martand Telsang	S. Chand & Company Ltd., New Delhi	Second	2006
03	Total Quality Management	Dr. Poornima Charantimath	Pearson Education Asia	Second	2012
04	Handbook of Total Quality Management	Dr. R.P. Mohanti, R.R. Lakhe	Jaico Publishing House	Second	2007

Reference Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Total Quality Control	Feigenban	McGraw Hill Book Company, New York	--	2007
02	Practical Reliability Engineering"	Patrick D.T. Connor,	Wiley India P. Ltd.	Fourth	2009
03	Introduction To Work Study	International Labour Office	International Labour Office,1969	Second	2008
04	Handbook of Total Quality Management"	Dr. R.P. Mohanti, R.R. Lakhe	Jaico Publishing House	Second	2007

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ANNASAHEB DANGE COLLEGE OF ENGINEERING AND TECHNOLOGY, ASHTA
(An Autonomous Institute)

Department of Mechanical Engineering

S. Y. B.Tech- (Mechanical Engineering)—Minor Stream Curriculum

Course Details:

Class	SY-B. Tech. Semester-IV-VII
Course Code and Course Title	**2MEIE451 Minor project**
Prerequisite/s	--
Teaching Scheme: Practical	03
Credits	03
Evaluation Scheme: ISE / ESE	50/50
Course Category	Skill development/Employability/Entrepreneurship

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
2MEIE451_1	**Identify** the real life institutional or industrial problem relevant to the societal, health & environmental issues for sustainable development.
2MEIE451_2	**Formulate**, **analyze** complex engineering problems and give cost-effective optimal solution.
2MEIE451_3	**Design** of components, system or processes that meet the specified needs by using advance tools/ techniques/ resources.
2MEIE451_4	**Interpret** the impact of solution by considering environmental issues, societal aspects like health, safety etc.
2MEIE451_5	**Apply** the engineering and management principles to manage projects maintaining professional and ethical principles as an individual or as a team.
2MEIE451_6	**Prepare** the design reports and make effective presentations on complex engineering activities.

Course contents:

- Minor project work can be a design project / experimental project and /or computer simulation project on mechanical engineering or any of the topics related with industrial engineering stream.
- Minor project can be consists of problem identification, literature review, formulation of problem, design of components/system/ process, modern tools used in the project.
- Submission of synopsis of selected project work. Synopsis report should highlight scope, objectives, methodology, approach and tools to be used like software, other expected results and outcomes along with time frame.
- One copy of the synopsis report should be expected to submit to project guide and one copy should remain with project group.
- Minor project work is divided in four semesters, to be extended with same group working under guidance of same project guide assigned for Project.

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Project work submitted by students shall include;

- The group of students (2 to 5) have to complete the minor project as follows:

Semester	Work to be completed	Assessment
IV	Literature review (Review Paper) and synopsis Presentation	Review-I
V	Methodology/Design	Review-II
VI	Complete Setup/Fabrication/Assembly	Review-III
VII	Testing, Report Writing, Paper Publication	Review-IV

- The report of the work completed in the form of project work diary, Minor project report and other relevant documents shall be submitted for the term work. The term work shall be assessed by the project guide and the assessment shall be based on a presentation of the work completed and submission of report.
- ***Work Diary*:** Work Diary maintained by group & countersigned by guide weekly. The contents of work diary shall reflect the efforts taken by project group for
- Searching suitable project work
- Brief report preferably on journals/ research or conference papers/ books or literature surveyed to select and bring up the project.
- Day to day activities carried out related to project work for entire semester.
- ***Synopsis report*:** The group should submit the synopsis in following prescribed format.
  - Title of Project
  - Names of Students
  - Name of Guide
  - Relevance
  - Literature review
  - Proposed work
  - Methodology
  - Expected outcomes
  - Plan of proposed work
  - Detailed Budget Estimate
  - References

  *Synopsis should consist of minimum **eight** review papers and shall be signed by the each student in the group, approved by the guide and endorsed by the Head of the Department.*
- ***Minor project report*:** Report should be of 25 to 30 pages (typed on A4 size sheets). For standardization of the Minor project reports the following format should be strictly followed.
  - Page Size: Trimmed A4
  - Top Margin: 1.00 Inch
  - Bottom Margin: 1.32 Inches
  - Left Margin: 1.5 Inches
  - Right Margin: 1.0 Inch
  - Para Text: Times New Roman 12 Point Font
  - Line Spacing: 1.5 Lines
  - Page Numbers: Right Aligned at Footer. Font 12 Point. Times New Roman
  - Headings: Times New Roman, 14 Point , Bold Face
  - References: References should have the following format

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- For Papers: *Authors, "Title of Paper",Publisher Details,Volume,Year,Page no*
- For Books: *Authors, "Title of Book", Publisher, Edition, page nos.*

Presentation of work

The student has to make a presentation in front of the faculty members and review panel member at the time of review's and submit presentation soft copy to project guide.

Important Notes:

- Project group should continue maintaining a work diary for project and should write (a) Book referred (b) Company visited (c) Person contacted (d) Paper referred (e) Creative thinking.
- Work diary along with Project report shall be assessed at the time of ESE examination

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