



# **Department of Mechanical Engineering**

**Academic Year 2023-24**



**3<sup>rd</sup> and 4<sup>th</sup> Semester**  
**Scheme and Syllabus**  
**BATCH – 2022-2026**  
**CREDITS: 160**

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## **NEW HORIZON COLLEGE OF ENGINEERING**

### **VISION**

To emerge as an institute of eminence in the fields of engineering, technology and management in serving the industry and the nation by empowering students with a high degree of technical, managerial and practical competence.

### **MISSION**

- To strengthen the theoretical, practical and ethical dimensions of the learning process by fostering a culture of research and innovation among faculty members and students.
- To encourage long-term interaction between the academia and industry through their involvement in the design of curriculum and its hands-on implementation.
- To strengthen and mould students in professional, ethical, social and environmental dimensions by encouraging participation in co-curricular and extracurricular activities.

### **QUALITY POLICY**

To provide educational services of the highest quality both curricular and co-curricular to enable students integrate skills and serve the industry and society equally well at global level

### **VALUES**

- Academic Freedom
- Integrity
- Inclusiveness
- Innovation
- Professionalism
- Social Responsibility

## DEPARTMENT OF MECHANICAL ENGINEERING

### VISION

To create competent mechanical engineers capable of working in diversified disciplines for transformative impact on societal progressive development in the field of mechanical engineering through creative research and lifelong learning

### MISSION

- To impart excellent education by providing the state of art research facilities in the field of mechanical engineering.
- To develop alliances with industries and other organizations for excellence in teaching learning process, research and consultancy projects.
- To enhance the knowledge of students in intellectual, entrepreneurial and ethical challenges through active participation by critical thinking.

### PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

- **PEO 1:** The graduates will be able to apply the overall knowledge of Mechanical Engineering along with concepts of Mathematics, Science, Communication and Computing skills to understand specific problem areas and finding the optimal solutions for the same.
- **PEO 2:** The graduates will be able to implement ideas of Mechanical Engineering for the challenging tasks in the interdisciplinary areas like Electrical, Electronics, Computer Science, Civil, Bio-Technology and allied branches.
- **PEO 3:** The graduates will be widely talented in the fields of manufacturing, service and design industries, which will not only improve their employability but also aid in establishing the above said industries.
- **PEO 4:** The graduates will develop lifelong learning attitudes, ethics and values that will help their career employability and growth in engineering, academia, defence, state and central government sectors.

### PEO TO MISSION STATEMENT MAPPING

Program Educational Objectives	M1	M2	M3
PEO 1	3	2	3
PEO 2	2	1	3
PEO 3	3	2	2
PEO 4	2	2	3

**PROGRAM OUTCOMES (POs)**

<b>Graduate Attributes</b>	<b>PO #</b>	<b>Program Outcomes</b>
Engineering knowledge	1	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex mechanical engineering problems
Problem Analysis	2	Identify, formulate, review research literature, and analyze complex engineering problems in Mechanical Engineering reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
Design Development of Solutions	3	Design solutions for complex engineering problems and design system components or processes of Mechanical Engineering that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
Conduct Investigations of Complex Problems	4	Use research-based knowledge and research methods including design of experiments in Mechanical Engineering, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
Modern tool usage	5	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities in Mechanical Engineering with an understanding of the limitations.
The Engineer and society	6	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice in Mechanical Engineering.
Environment and Sustainability	7	Understand the impact of the professional engineering solutions of mechanical Engineering in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
Ethics	8	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
Individual & team work	9	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
Communication	10	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
Project management and finance	11	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, manage projects and in multidisciplinary environments.
Lifelong learning	12	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

**PROGRAM SPECIFIC OUTCOMES (PSOs)**

After successful completion of mechanical Engineering Program, the graduates will be able to:

PSO1	Specify, fabricate, test and operate various machines along with essential documentations.
PSO2	Analyze, design, develop and implement the concepts of mechanical systems and processes towards product development

III Semester Scheme													
S. No.	Course and Course Code		Course Title	BoS	Credit Distribution				Overall Credits	Contact Hours	Marks		
					L	T	P	S			CIE	SEE	Total
1	BSC	22MAE31	Numerical Methods and Transforms	BS	3	0	0	0	3	3	50	50	100
2	PCC	22MEE32	Mechanics of Materials	ME	3	0	0	0	3	3	50	50	100
3	PCCL	22MEL32	Mechanics of Materials Lab	ME	0	0	1	0	1	2	50	50	100
4	PCC	22MEE33	Fluid Mechanics and Machinery	ME	3	0	0	0	3	3	50	50	100
5	PCCL	22MEL33	Fluid Mechanics and Machinery Lab	ME	0	0	1	0	1	2	50	50	100
6	PLC	22MEE34 X	Programming Language Course	ME	2	0	1	0	3	4	50	50	100
7	AEC	22MEE35 X	Ability Enhancement Course - III	ME	If the course is a Theory					50	50	100	
					1	0	0	0	1				1
					If the course is a Laboratory								
					0	0	1	0	1	2			
8	BSC	22BIK36	Bio Inspired Design and Innovation	Any Dept	3	0	0	0	3	3	50	50	100
9	UHV	22SCK37	Social Connect and Responsibility	Any Dept	0	0	1	0	1	2	50	--	50
10	NCMC	22NSS30	National Service Scheme (NSS)	NSS coordinator	0	0	0	0	0	2	50	--	50
		22PED30	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		22YOG30	Yoga	Yoga Teacher									
Total									19	25/26	500	400	900

11	NCMC	22DMAT31*	Basic Applied Mathematics -I	BS	0	0	0	0	0	2	50	--	50
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**BSC:** Basic Science Course, **PCC:** Professional Core Course, **PCCL:** Professional Core Course laboratory, **UHV:** Universal Human Value Course, **NCMC:** Non-Credit Mandatory Course, **AEC:** Ability Enhancement Course, **L:** Lecture, **T:** Tutorial, **P:** Practical **S:** SDA: Self Study for Skill Development, **K:** This letter in the course code indicates common to all the stream of engineering. **ESC:** Engineering Science Course, **ETC:** Emerging Technology Course, **PLC:** Programming Language Course, **CIE:** Continuous Internal Evaluation, **SEE:** Semester End Evaluation.

**22DMAT31\*:** This non-credit mandatory course to be offered with only CIE and no SEE to Lateral entry students.

Programming Language Course (PLC)			
22MEE341	Object oriented programming using Java	22MEE343	Introduction to AI
22MEE342	Advanced python Programming	22MEE344	EDA(Exploratory Data Analysis) using Modern Tools

Ability Enhancement Course – III			
22MEE351	Computer Aided Machine Drawing (0-0-1-0)	22MEE353	Tool Engineering(1-0-0-0)
22MEE352	Excel in MS Excel[1-0-0-0)	22MEE354	Industrial Waste Management(1-0-0-0)

**National Service Scheme /Physical Education/Yoga:** All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education(PE) (Sports and Athletics), and Yoga (YOG) with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

<p><b>Credit Definition:</b>            1-hour Lecture (L) per week=1Credit            2-hours Tutorial(T) per week=1Credit            2-hours Practical / Drawing (P) per week=1Credit            2-hous Self Study for Skill Development (SDA) per week = 1 Credit</p>	<p>03-Credits courses are to be designed for 40 hours in Teaching-Learning Session            02- Credits courses are to be designed for 25 hours of Teaching-Learning Session            01-Credit courses are to be designed for 15 hours of Teaching-Learning Sessions</p>
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IV Semester Scheme													
S. No.	Course and Course Code		Course Title	BoS	Credit Distribution				Overall Credits	Contact Hours	Marks		
					L	T	P	S			CIE	SEE	Total
1	BSC	22MAE41	Numerical, Complex Analysis and Probability Theory	BS	3	0	0	0	3	3	50	50	100
2	PCC	22MEE42	Engineering Thermodynamics	ME	3	0	0	0	3	3	50	50	100
3	PCCL	22MEL42	Engineering Thermodynamics Lab	ME	0	0	1	0	1	2	50	50	100
4	PCC	22MEE43	Manufacturing Technology	ME	3	0	0	0	3	3	50	50	100
5	PCCL	22MEL43	Manufacturing Technology Lab	ME	0	0	1	0	1	2	50	50	100
6	PCC	22MEE44	Mechanical Measurements and Metrology	ME	3	0	0	0	3	3	50	50	100
7	PCCL	22MEL44	Mechanical Measurements and Metrology Lab	ME	0	0	1	0	1	2	50	50	100
8	ETC	22MEE45 X	Emerging Technology Course	ME	3	0	0	0	3	3	50	50	100
9	AEC	22MEE46 X	Ability Enhancement Course - IV	ME	If the course is a Theory					50	50	100	
					1	0	0	0	1				1
					If the course is a Laboratory								
					0	0	1	0	1	2			
10	UHV	22UHK47	Universal Human Values and Life skills	Any Dept	1	0	0	0	1	2	50	--	50
11	PROJ	22MEE48	Mini Project	ME	0	0	1	0	1	2	50	50	100
12	NCMC	22NSS40	National Service Scheme (NSS)	NSS coordinator	0	0	0	0	0	2	50	--	50
		22PED40	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		22YOG40	Yoga	Yoga Teacher									
Total									21	28/29	600	500	1100

13	NCMC	22DMAT41 *	Basic Applied Mathematics - II	BS	0	0	0	0	0	0	2	50	--	50
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**BSC:** Basic Science Course, **PCC:** Professional Core Course, **PCCL:** Professional Core Course laboratory, **UHV:** Universal Human Value Course, **NCMC:** Non-Credit Mandatory Course, **AEC:** Ability Enhancement Course, **L:** Lecture, **T:** Tutorial, **P:** Practical **S:** **SDA:** Self Study for Skill Development, **K:** This letter in the course code indicates common to all the stream of engineering. **ESC:** Engineering Science Course, **ETC:** Emerging Technology Course, **PLC:** Programming Language Course, **CIE:** Continuous Internal Evaluation, **SEE:** Semester End Evaluation.

**22DMAT41\*:** This non-credit mandatory course to be offered with only CIE and no SEE to Lateral entry students.

Emerging Technology Course (ETC)			
22MEE451	Programming for IoT	22MEE453	Introduction to Machine learning
22MEE452	Essential of cyber security	22MEE454	Robotic Programming

Ability Enhancement Course – IV			
22MEE461	Mat Lab for Mechanical Engineers (0-0-1-0)	22MEE463	Disaster Management (0-0-1-0)
22MEE462	Energy management and auditing (0-0-1-0)	22MEE464	Air Pollution Control (1-0-0-0)

**Mini-project work:** Mini Project is a laboratory-oriented/hands on course that will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications etc. Based on the ability/abilities of the student/s and recommendations of the mentor. A student can do mini project as

- (i) A group of 2 if mini project work is single discipline (applicable to all IT allied branches)
- (ii) A group of 2- 4 if mini project work is single discipline (applicable to all Core Branches)
- (iii) A group of 2 - 4 students if the Mini Project work is a multidisciplinary (Applicable to all Branches)

**CIE procedure for Mini-project:**

**(i) Single discipline:** The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two faculty members of the Department, one of them being the Guide. The CIE marks awarded for the Mini-project work shall be based on the evaluation of the project report, project presentation skill, and question and answer session in the ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batches mates.

**(ii) Interdisciplinary:** Continuous Internal Evaluation shall be group-wise at the college level with the participation of all the guides of the project.

The CIE marks awarded for the Mini-project, shall be based on the evaluation of the project report, project presentation skill, and question and answer session in the percentage ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batch mates

**National Service Scheme /Physical Education/Yoga:** All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE) (Sports and Athletics), and Yoga (YOG) with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory

for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

<p><b>Credit Definition:</b>          1-hour Lecture (L) per week=1Credit          2-hours Tutorial(T) per week=1Credit          2-hours Practical / Drawing (P) per week=1Credit          2-hous Self Study for Skill Development (SDA) per week = 1 Credit</p>	<p>03-Credits courses are to be designed for 40 hours in Teaching-Learning Session          02- Credits courses are to be designed for 25 hours of Teaching-Learning Session          01-Credit courses are to be designed for 15 hours of Teaching-Learning Sessions</p>
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## **III Semester Syllabus**

NUMERICAL METHODS AND TRANSFORMS												
Course Code	22MAE31						CIE Marks				50	
L:T:P:S	3:0:0:0						SEE Marks				50	
Hrs. / Week	03						Total Marks				100	
Credits	03						Exam Hours				03	
<b>Course outcomes:</b>												
At the end of the course, the student will be able to:												
22MAE31.1	Use appropriate numerical methods to solve algebraic equations and transcendental equations.											
22MAE31.2	Differentiate the physical problems numerically, evaluate a definite integral numerically and use appropriate numerical methods to solve boundary value problems in partial differential equations.											
22MAE31.3	Justify Z-transforms method to solve continuous/discrete model problems.											
22MAE31.4	Express the periodic functions as Fourier series expansion analytically and numerically.											
22MAE31.5	Solve the continuous model problems using Fourier transform.											
22MAE31.6	Analyze the Fast Fourier transforms method to solve the discrete model problems.											
<b>Mapping of Course Outcomes to Program Outcomes:</b>												
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
22MAE31.1	3	3	-	-	-	-	-	-	-	-	-	-
22MAE31.2	3	3	-	-	-	-	-	-	-	-	-	-
22MAE31.3	3	3	-	-	-	-	-	-	-	-	-	-
22MAE31.4	3	3	-	-	-	-	-	-	-	-	-	-
22MAE31.5	3	3	-	-	-	-	-	-	-	-	-	-
22MAE31.6	3	3	-	-	-	-	-	-	-	-	-	-
<b>MODULE-1 NUMERICAL METHODS-1 22MAE31.1 8 Hours</b>												
Numerical solution of algebraic and transcendental equations: Newton-Raphson Method-Problems. Interpolation: Newton's forward and backward formulae for equal intervals, Newton divided difference, Lagrange's formula and Lagrange's inverse interpolation formula for unequal intervals (without proofs)-Problems.												
Case Study	Case studies on Numerical Analysis.											
Text Book	Text Book 1: 28.2, 28.3, 29.6, 29.10, 29.12, 29.13. Text Book 3: 19.2, 19.3.											
<b>MODULE-2 NUMERICAL METHODS-2 22MAE31.2 8 Hours</b>												
Numerical Differentiation: Derivatives of first order and second order using Newton's forward differences and Newton's backward differences.												
Numerical integration: Trapezoidal rule and Simpson's 1/3rd rule (without proofs)-Problems.												
Applications	Application of numerical integration to velocity of a particle and volume of solids. Numerical solution of one-dimensional wave equation, heat equation and two-dimensional Laplace's equation.											
Text Book	Text Book 1: 30.2, 30.6, 30.7, 29.6, 29.10, 29.12, 29.13, Text Book 3: 19.5.											
<b>MODULE-3 Z-TRANSFORM 22MAE31.3 8 Hours</b>												
Definition, Z-transforms of some standard functions, properties, damping rule, shifting rule (without proof), initial and final value theorems, inverse Z- transforms by partial fractions method.												
Applications	Applications: Solving difference equations using Z-transform.											
Text Book	Text Book 1: 23.3, 23.4, 23.5, 23.6, 23.9, 23.15, 23.16. Text Book 2: 6.14.11, 6.14.12											
<b>MODULE-4 FOURIER SERIES 22MAE31.4 8 Hours</b>												
Periodic function, Dirichlet's conditions, Fourier series of periodic functions of period $2\pi$ and arbitrary period $2l$ , half range series-Problems.												
Applications	Applications: Practical harmonic analysis-Problems.											
Text Book	Text Book 1: 10.2, 10.4, 10.5, 10.6, 10.7, 10.11, Text Book 3: 11.1											
<b>MODULE-5 FOURIER TRANSFORMS, DISCRETE AND FAST FOURIER 22MAE31.5 8 Hours</b>												

		<b>TRANSFORMS</b>		<b>22MAE31.6</b>	
Fourier Transforms: Infinite Fourier transforms, Fourier Sine and Cosine transforms, Inverse Fourier sine and cosine transforms. Discrete Fourier Transform and Fast Fourier Transform: Definition of N-Point DFT, problems for 4-points and inverse DFT for four points only. FFT algorithm to compute the Fourier transforms 4-point only.					
Text Book		Text Book 1: 22.4, 22.5, Text Book 2:8.3, 8.4, 9.2, 9.3, Text Book 3: 11.9			
<b>CIE Assessment Pattern (50 Marks - Theory)</b>					
<b>RBT Levels</b>		<b>Marks Distribution</b>			
		<b>Test (s)</b>	<b>Qualitative Assessment (s)</b>	<b>MCQ's</b>	
		<b>25</b>	<b>15</b>	<b>10</b>	
<b>L1</b>	<b>Remember</b>	5	5	-	
<b>L2</b>	<b>Understand</b>	5	5	-	
<b>L3</b>	<b>Apply</b>	10	5	10	
<b>L4</b>	<b>Analyze</b>	2.5	-	-	
<b>L5</b>	<b>Evaluate</b>	2.5	-	-	
<b>L6</b>	<b>Create</b>	-	-	-	
<b>SEE Assessment Pattern (50 Marks - Theory)</b>					
<b>RBT Levels</b>		<b>Exam Marks Distribution (50)</b>			
<b>L1</b>	<b>Remember</b>	<b>10</b>			
<b>L2</b>	<b>Understand</b>	<b>10</b>			
<b>L3</b>	<b>Apply</b>	<b>20</b>			
<b>L4</b>	<b>Analyze</b>	<b>5</b>			
<b>L5</b>	<b>Evaluate</b>	<b>5</b>			
<b>L6</b>	<b>Create</b>	<b>-</b>			
<b>Suggested Learning Resources:</b>					
<b>Text Books:</b>					
1) B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, Forty fourth Edition, 2022, ISBN: 9788193328491.					
2) Tarun Kumar Rawat, Digital Signal Processing, Oxford University Press, Wiley-India Publishers, Second impression, 2015, ISBN: 9780198081937.					
3) Erwin Kreyszig, Advanced Engineering Mathematics, Wiley-India Publishers, Tenth Edition, Reprint 2016, ISBN: 9788126554232.					
<b>Reference Books:</b>					
1) Glyn James, Advanced Modern Engineering Mathematics, Pearson Education, Fourth Edition, 2015, ISBN: 9780273719236.					
2) B. V. Ramana, Higher Engineering Mathematics, McGraw Hill Education (India) Private Limited, Fourth Edition, 2017, ISBN: 9780070634190.					
3) H. K. Dass, Advanced Engineering Mathematics, S. Chand & Company Ltd., Twenty Second Edition, 2018, ISBN: 9789352533831.					
4) N.P.Bali and Manish Goyal, A Text Book of Engineering Mathematics, Laxmi Publications (P) Ltd., Ninth Edition, 2014, ISBN: 9788131808320.					
<b>Web links and Video Lectures (e-Resources):</b>					
1) <a href="https://youtu.be/IgoJV4g_0LM?si=JO1_bkIvMR8xlCOV">https://youtu.be/IgoJV4g_0LM?si=JO1_bkIvMR8xlCOV</a>					
2) <a href="https://youtu.be/mIFwzg11uO4?si=Xd13dh0eNlmlswPS">https://youtu.be/mIFwzg11uO4?si=Xd13dh0eNlmlswPS</a>					
3) <a href="https://youtu.be/74g5_3TC-tQ?si=yB2PHVGr4hxllqPo">https://youtu.be/74g5_3TC-tQ?si=yB2PHVGr4hxllqPo</a>					
4) <a href="https://youtu.be/QQFIWwDA9NM?si=3wjrtlm1NdPSbXmB">https://youtu.be/QQFIWwDA9NM?si=3wjrtlm1NdPSbXmB</a>					
5) <a href="https://youtu.be/5817fLmsTGE?si=Y7ORyV2ETSCxZRAZ">https://youtu.be/5817fLmsTGE?si=Y7ORyV2ETSCxZRAZ</a>					
6) <a href="https://youtu.be/XJRW6jamUHK?si=G_UTgCM622bz9yh4">https://youtu.be/XJRW6jamUHK?si=G_UTgCM622bz9yh4</a>					
7) <a href="https://youtu.be/QHH50jy8s_A?si=eNUoUXYLEvEZj3KM">https://youtu.be/QHH50jy8s_A?si=eNUoUXYLEvEZj3KM</a>					

- 8) <https://youtu.be/m3mMeXLt2OQ?si=r9QXzwCRo0PC0ewz>
- 9) <https://youtu.be/aSu5Yde9Sfk?si=6kZbU3QRXEfEn2ua>
- 10) <https://www.youtube.com/live/tjBxcBLBe6I?si=v4RH4oqyttKhfaPd>
- 11) [https://youtu.be/-Y\\_0FY-IDrI?si=-ERIHGln3U2dr54J](https://youtu.be/-Y_0FY-IDrI?si=-ERIHGln3U2dr54J)
- 12) <https://youtu.be/zWRVxWdwXaw?si=Y78g7TogvDZIKhvs>
- 13) <https://youtu.be/nl9TZanwbBk?si=LdywSeCJ0EIt5zCx>
- 14) <https://youtu.be/E8HeD-MUrjY?si=JWwQzkQWfaTIqVhG>

**Activity-Based Learning (Suggested Activities in Class)/Practical Based Learning:**

- Contents related activities (Activity-based discussions)
  - For active participation of students, instruct the students to prepare Algorithms/Flowcharts/Programming Codes
  - Organizing Group wise discussions on related topics
  - Seminars

<b>MECHANICS OF MATERIALS</b>														
<b>Course Code</b>	<b>22MEE32</b>						<b>CIE Marks</b>			<b>50</b>				
<b>L:T:P:S</b>	<b>3:0:0:0</b>						<b>SEE Marks</b>			<b>50</b>				
<b>Hrs / Week</b>	<b>03</b>						<b>Total Marks</b>			<b>100</b>				
<b>Credits</b>	<b>03</b>						<b>Exam Hours</b>			<b>03</b>				
<b>Course outcomes:</b>														
At the end of the course, the student will be able to:														
22MEE32.1	Understand the material properties and calculate the simple stresses and strains induced in various bars of different cross sections.													
22MEE32.2	Identify the behavior of beams under various loads, thereby determine deflection and also plot the shear force and bending moment diagrams.													
22MEE32.3	Analyze the effects of bending and shear loads on structural members.													
22MEE32.4	Develop a working knowledge of the analytical methodologies used in column structural design.													
22MEE32.5	Design circular shafts subjected to torsional loads and, compute the stresses and strains in thick and thin cylindrical pressure vessels.													
22MEE32.6	Apply structural mechanics of deformable bodies to solve engineering problems.													
<b>Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:</b>														
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>
22MEE32.1	3	3	2	2	-	-	-	-	-	-	-	-	-	2
22MEE32.2	3	3	2	2	-	-	-	-	-	-	-	-	-	2
22MEE32.3	3	3	2	2	-	-	-	-	-	-	-	-	-	2
22MEE32.4	3	3	2	2	-	-	-	-	-	-	-	-	-	2
22MEE32.5	3	3	2	2	-	-	-	-	-	-	-	-	-	2
22MEE32.6	3	3	2	2	-	-	-	-	-	-	-	-	-	2
<b>MODULE-1</b>														
<b>SIMPLE STRESS AND STRAIN</b>		<b>22MEE32.1, 22MEE32.6</b>										<b>8 Hours</b>		
Assumptions in MOM, stress, strain, mechanical properties of materials, Hooke's Law and Poisson's ratio, Stress-Strain curve for Mild steel, cast iron and Aluminium. Extension /Shortening of a bar, bars with cross section varying in steps, bars with continuously varying cross sections (circular and rectangular), Elongation due to self-weight, Principle of super position and numericals, Thermal Stresses (Non numericals), elastic constants (only definitions). Definition of Indeterminate structures.														
Self-study / Case Study / Applications		Study the mechanical properties of various materials and their applications												
Text Book		Text Book 1: 2.1,2.2,2.4,2.5,2.6,2.7 Text Book 2: Page No. 1-90												
<b>MODULE-2</b>														
<b>BENDING MOMENT AND SHEAR FORCE DIAGRAMS</b>		<b>22MEE32.2, 22MEE32.6</b>										<b>8 Hours</b>		
Introduction, Types of beams, loads and reactions, shear forces and bending moments, Rate of loading, sign conventions, relationship between shear force and bending moments. Shear force and bending moment diagrams for different beams subjected to concentrated loads, uniformly distributed load, (UDL) uniformly varying load (UVL) and couple for different types of beams, numericals.														
Self-study / Case Study / Applications		Study the various types of load acting on various structural members.												
Text Book/Reference Book		Text Book 1:5.1,5.2,5.3 Text Book 2: Page No.160-282												



<b>MODULE-3</b>	<b>BENDING AND SHEAR STRESSES IN BEAMS</b>	<b>22MEE32.3, 22MEE32.6</b>	<b>8 Hours</b>	
Introduction, Theory of simple bending, assumptions in simple bending. Bending stress equation, relationship between bending stress and radius of curvature, relationship between bending moment and radius of curvature. Moment carrying capacity of a section. Shearing stresses in beams, shear stress across rectangular, circular, symmetrical I and T sections.				
Self-study / Case Study / Applications	Study the importance of moment of inertia and kinds of cross sections for beams.			
Text Book	Text Book 1:4.1,4.2,4.6,4.8,6.1,6.2,6.3 Text Book 2: Page No.283-333			
<b>MODULE-4</b>	<b>DEFLECTION OF BEAMS AND ELASTIC STABILITY OF COLUMNS</b>	<b>22MEE32.2 22MEE32.4 22MEE32.6</b>	<b>8 Hours</b>	
Deflection of Beams: Introduction, Differential equation for deflection. Equations for deflection, slope and bending moment. Double integration method for cantilever and simply supported beams for point load, UDL, UVL and Couple, Macaulay's method. Elastic Stability of Columns: Introduction, Columns and struts, slenderness ratio, Classification of columns, buckling load or critical load, Sign conventions, Euler's theory of buckling, Effective length for various boundary conditions, Limitations of Euler's theory, Rankine formula, numericals.				
Self-study / Case Study / Applications	Study the importance of deflection of beams and slenderness ratio and applications of Euler's critical load in the design of long columns.			
Text Book	Text Book 1: 9.1,9.2,9.3,10.1,10.2,10.3,10.4 Text Book 2:Page No.441-575 and 982-1010			
<b>MODULE-5</b>	<b>TORSION OF CIRCULAR SHAFTS, THICK AND THIN CYLINDERS</b>	<b>22MEE32.5 22MEE32.6</b>	<b>8 Hours</b>	
Torsion of Circular Shafts: Introduction, Pure torsion, assumptions, derivation of torsional equations, polar modulus, Torsional rigidity / stiffness of shafts. Power transmitted by solid and hollow circular shafts, numericals. Thick and Thin Cylinders: Stresses in thin cylinders, changes in dimensions of cylinder (diameter, length and volume). Thick cylinders - Lamé's equation, Problems on Lamé's equation.				
Self-study / Case Study / Applications	Study the importance of design parameters in the design of Boilers, Tanks and Gun Barrels etc. Also study the importance of design of shafts.			
Text Book/Reference Book	Text Book 1:3.1,3.2 Text Book 2: Page No.759-798 and 945-981			
<b>CIE Assessment Pattern (50 Marks - Theory)</b>				
<b>RBT Levels</b>		<b>Marks Distribution</b>		
		<b>Test (s)</b>	<b>Qualitative Assessment (s)</b>	<b>MCQ's</b>
		<b>25</b>	<b>15</b>	<b>10</b>
<b>L1</b>	<b>Remember</b>	5	-	-
<b>L2</b>	<b>Understand</b>	5	-	-
<b>L3</b>	<b>Apply</b>	5	5	5

L4	Analyze	5	5	5
L5	Evaluate	5	5	-
L6	Create	-	-	-

**SEE Assessment Pattern (50 Marks – Theory)**

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	--

**Suggested Learning Resources:**

**Text Books:**

- 1) Ferdinand Beer & Russell Johnston., 'Mechanics of Materials', McGraw Hill India, 7th Edition, 2016, ISBN-(13 digits): 9789339217624.
- 2) Ramamrutham S., 'Strength of Materials', Dhanpat Rai Publishing Co Pvt Ltd, 16th Edition, 2008, ISBN-81-27-433-54-X.

**Reference Books:**

- 1) R C Hibbeler., 'Mechanics of Materials', Pearson Education, 9th Edition, 2018, ISBN-(13 digits): 978-9332584037; ISBN-(10 digits): 9332584036.
- 2) James M. Gere, Barry J. Goodno., 'Mechanics of Materials', Cengage Learning, 8th Edition, 2014, ISBN-(13 digits): 9788131524749.
- 3) S S Rattan., 'Strength of Materials', McGraw Hill India, 2nd Edition, 2011, ISBN-(13 digits): 978-0071072564; ISBN-(10 digits): 007107256X.

**Web links and Video Lectures (e-Resources):**

- [https://www.youtube.com/watch?v=La4UEa7hA7Q&list=PLJoALJA\\_KMOARYNi50T6b488kPU\\_BbOIsX](https://www.youtube.com/watch?v=La4UEa7hA7Q&list=PLJoALJA_KMOARYNi50T6b488kPU_BbOIsX)
- <https://www.youtube.com/watch?v=GkFgysZC4Vc>
- <https://www.youtube.com/watch?v=aQf6Q8t1FQE&list=PLEYqvyrm-hQ3wtF34smyJSAOqUJqnf1ch>
- [https://www.youtube.com/watch?v=B9lyGZzb\\_6M&list=PLlhUrsYr8yHzft7ygw5THZo4aD\\_csxEadP](https://www.youtube.com/watch?v=B9lyGZzb_6M&list=PLlhUrsYr8yHzft7ygw5THZo4aD_csxEadP)
- <https://www.youtube.com/watch?v=MFsirsHnQi4>
- [https://www.youtube.com/watch?v=ihsnQWp09zg&list=PLDN15nk5uLiCAnu7Rjta7vvNh\\_oJZv\\_gAt](https://www.youtube.com/watch?v=ihsnQWp09zg&list=PLDN15nk5uLiCAnu7Rjta7vvNh_oJZv_gAt)

**Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning**

- Visit to any design department of manufacturing/aero/auto industry
- Demonstration of short, medium and long columns
- Video demonstration of finding the mechanical properties of materials.
- Contents related activities (Activity-based discussions)
  - Organizing Group wise discussions on issues
  - Seminars

<b>MECHANICS OF MATERIALS LAB</b>														
<b>Course Code</b>	22MEL32								<b>CIE Marks</b>			50		
<b>L:T:P:S</b>	0:0:1:0								<b>SEE Marks</b>			50		
<b>Hrs / Week</b>	2								<b>Total Marks</b>			100		
<b>Credits</b>	01								<b>Exam Hours</b>			03		
<b>Course outcomes:</b>														
At the end of the course, the student will be able to:														
22MEL32.1	Identify the microstructure details of Ferrous and nonferrous materials.													
22MEL32.2	Evaluate the mechanical properties of various materials subjected to axial, bending and torsional loads.													
22MEL32.3	Determine the impact strength, hardness and wear rate of various materials.													
22MEL32.4	Identify the surface defects through NDT techniques for ferrous and nonferrous materials.													
<b>Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:</b>														
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PS01</b>	<b>PS02</b>
22MEL32.1	3	3	2	-	-	-	-	-	-	-	-	-	3	-
22MEL32.2	3	3	2	-	-	-	-	-	-	-	-	-	3	-
22MEL32.3	3	3	2	-	-	-	-	-	-	-	-	-	3	-
22MEL32.4	3	3	2	-	-	-	-	-	-	-	-	-	3	-
<b>Exp. No.</b>	<b>List of Experiments</b>											<b>Hours</b>	<b>COs</b>	
<b>Prerequisite Experiments / Demo</b>														
	<b>Demo:</b> To determine the wear rate of the given specimen using Pin on Disc apparatus.											2	NA	
<b>PART-A</b>														
1	To determine the hardness number of a given material using Brinell hardness test.											2	22MEL32.3	
2	Evaluating the hardness number of hardened steel specimen using Vickers's hardness test.											2	22MEL32.3	
3	To determine the hardness number of mild steel/cast iron specimen using Rockwell hardness test.											2	22MEL32.3	
4	To determine the impact energy and strength of notched specimen using Charpy and Izod tests.											2	22MEL32.3	
5	Determination of defects in a given material using magnetic crack detector.											2	22MEL32.4	
6	Determination of cracks in given material using dye penetrant test.											2	22MEL32.4	
<b>PART-B</b>														
7	To determine the ultimate shear strength of the given specimen in single and double shear using UTM.											2	22MEL32.2	
8	To determine the moment of inertia, modulus of elasticity and maximum bending stress of wood specimen by conducting bending test.											2	22MEL32.2	
9	To determine the compressive strength, modulus of elasticity, % reduction in length and % increase in area of cast iron specimen by conducting compression test on universal testing machine.											2	22MEL32.2	

10	To determine the modulus of rigidity, Torsional strength and modulus of toughness of mild steel specimen using torsion test.	2	22MEL32.2
11	To determine the elastic strength, ultimate tensile strength, modulus of toughness and young's modulus of mild steel specimen by conducting tensile test on universal testing machine.	2	22MEL32.2
12	Metallographic examination and identification of microstructures of ferrous and non-ferrous materials materials.	2	22MEL32.1

**PART-C**  
**Beyond Syllabus Virtual Lab Content**

**1. Izod Impact Test**

<https://sm-nitk.vlabs.ac.in/exp/izod-impact-test/>

**2. Charpy Impact Test**

<https://sm-nitk.vlabs.ac.in/exp/charpy-impact-test/>

**3. Brinell Hardness Test**

<https://sm-nitk.vlabs.ac.in/exp/brinell-hardness-test/>

**4. Rockwell Hardness Test**

<https://sm-nitk.vlabs.ac.in/exp/rockwell-hardness-test/>

**5. Vickers Hardness Test**

<https://sm-nitk.vlabs.ac.in/exp/vickers-hardness-test/>

**6. Tensile Test on Mild Steel**

<https://sm-nitk.vlabs.ac.in/exp/tensile-test-mild-steel/>

**7. Compression Test**

<https://sm-nitk.vlabs.ac.in/exp/compression-test-cast-iron/>

<https://sm-nitk.vlabs.ac.in/exp/compression-test-mild-steel/>

**8. Torsion Test on Mild Steel**

<https://sm-nitk.vlabs.ac.in/exp/torsion-test-mild-steel/>

**9. Shear Test**

<https://sm-nitk.vlabs.ac.in/exp/direct-shear-test-timber/>

<https://sm-nitk.vlabs.ac.in/exp/direct-shear-test-steel-plate/>

**(To be done during Lab but not to be included for CIE or SEE)**

**CIE Assessment Pattern (50 Marks – Lab)**

RBT Levels		Test (s)	Weekly Assessment
		20	30
L1	Remember	-	-
L2	Understand	5	5
L3	Apply	5	10
L4	Analyze	5	10
L5	Evaluate	5	5
L6	Create	-	-

**SEE Assessment Pattern (50 Marks – Lab)**

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	05
L3	Apply	10
L4	Analyze	20
L5	Evaluate	15
L6	Create	-

**Suggested Learning Resources:****Reference Books:**

- 1) R C Hibbeler, 'Mechanics of Materials', Pearson Education, 9th Edition, 2018, ISBN-(13 digits): 978-9332584037; ISBN-(10 digits): 9332584036.
- 2) James M. Gere, Barry J. Goodno, 'Mechanics of Materials', Cengage Learning, 8th Edition, 2014, ISBN-(13 digits): 9788131524749.
- 3) S S Rattan., 'Strength of Materials', McGraw Hill India, 2nd Edition, 2011, ISBN-(13 digits): 978-0071072564; ISBN-(10 digits): 007107256X.

<b>FLUID MECHANICS AND MACHINERY</b>														
<b>Course Code</b>	<b>22MEE33</b>								<b>CIE Marks</b>				<b>50</b>	
<b>L:T:P:S</b>	<b>3:0:0:0</b>								<b>SEE Marks</b>				<b>50</b>	
<b>Hrs / Week</b>	<b>03</b>								<b>Total Marks</b>				<b>100</b>	
<b>Credits</b>	<b>03</b>								<b>Exam Hours</b>				<b>03</b>	
<b>Course outcomes:</b>														
At the end of the course, the student will be able to:														
22MEE33.1	Understand the properties of fluids and compute the parametric behaviour when acting on simple aerodynamic profiles and shapes in steady fluid flows.													
22MEE33.2	Identify the various losses for fluids flowing through a pipe and implement the concepts of fluid statics, fluid kinematics and fluid dynamics in the applications of Hydraulics machinery													
22MEE33.3	Analyze the types of fluid flow, different flow description and design a flow measuring device to analyze the discharge of fluid													
22MEE33.4	Determine various equipment sizing / design aspects of turbo machines based on engineering requirement with the application of Continuity and Bernoulli's equations in order to develop solution for fluid flow process													
22MEE33.5	Investigate the concepts and make an effective presentation on the application of suitable turbo machines under / within the specified conditions													
22MEE33.6	Design and analysis of turbo machines by applying the knowledge to practical engineering problems for better sustainable solutions.													
<b>Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:</b>														
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>
22MEE33.1	3	3		-	-	-	-	-	-	-	-	-	-	3
22MEE33.2	3	3		-	-	-	-	-	-	-	-	-	-	3
22MEE33.3	3	3	3	-	-	-	-	-	-	-	-	-	3	3
22MEE33.4	3			-	-	-	-	-	-	-	-	-	3	-
22MEE33.5				-	-	-	-	-	-	-	-	-	-	-
22MEE33.6	3	3	3	-	-	-	-	-	-	-	-	1	3	-
<b>MODULE-1</b>	<b>FLUID PROPERTIES AND BUOYANCY</b>								<b>22MEE33.1</b> <b>22MEE33.2</b>				<b>8 Hours</b>	
<b>Fluid Properties and Fluid Statics:</b> Fluid properties, Numerical on Fluid properties, Types of fluids, Pascal's law, Hydrostatic law (No numerical). <b>Buoyancy:</b> Buoyancy, centre of buoyancy, Archimedes' principle, metacentre and metacentric height, stability of floating and submerged bodies, determination of Metacentric height by experimental method. (Numerical on Meta centre and centre of Buoyancy)														
Case study			Case Study on determination of Metacentric height											
Text Book			Text Book 1: 1.1, 1.2, 1.3, 1.6, 2.1, 2.2, 2.3, 4.1, 4.2, 4.3, 4.4, 4.5 Text Book 2: 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 2.3, 4.1, 4.2, 4.3, 4.4											
<b>MODULE-2</b>	<b>FLUID KINEMATICS AND FLUID DYNAMICS</b>								<b>22MEE33.2</b> <b>22MEE33.3</b> <b>22MEE33.4</b>				<b>8 Hours</b>	
<b>Fluid Kinematics:</b> Types of Flow, Continuity equation in 3D (Cartesian Co-ordinates only), velocity and acceleration, velocity potential function and stream function (Numerical). <b>Fluid Dynamics:</b> Euler equation of motion and Bernoulli's equation from Euler's equation (Numerical). Application of Bernoulli's equation to Pitot tube, venturimeter, orifice meter (No Derivation and No Numerical).														
Case Study/Applications			Case Study on Design & Fabrication of stepped notch/trapezoidal notch											
Text Book			Text Book 5.1, 5.2, 5.3, 5.4, 5.5, 5.7, 5.8, 6.1, 6.2, 6.3, 6.4, 7.1, 7.3 Text Book 2: 5.1, 5.3, 5.6, 6.1, 6.3, 6.4, 6.6											

<b>MODULE-3</b>	<b>FLOW THROUGH PIPES, LAMINAR AND TURBULENT FLOW</b>	<b>22MEE33.2 22MEE33.3 22MEE33.4</b>	<b>8 Hours</b>	
<p><b>Flow Through Pipes:</b> Energy losses through pipe, Major losses, Darcy- Weisbach equation, Chezy's Equation, Minor losses in pipes-sudden enlargement, sudden contraction (Numerical).  <b>Laminar And Turbulent Flow:</b> Definition, Relation between pressure and shear stresses, Laminar flow through circular pipe, Fixed parallel plates, Turbulent flow and velocity distribution. (Numerical)</p>				
Case Study	Case study on Major and Minor losses in flow through pipes			
Text Book	Text Book 1: 9.1, 9.2, 9.3, 10.1, 10.2, 10.3 Text Book 2: 11.2, 11.2, 10.4, 10.5			
<b>MODULE-4</b>	<b>Hydraulic Pumps</b>	<b>22MEE33.4 22MEE33.5 22MEE33.6</b>	<b>8 Hours</b>	
<p><b>Hydraulic pumps:</b> Concept and classification of pumps, Detailed study (construction, working and applications) of Centrifugal pump &amp; Reciprocating pump. Performance (efficiency, discharge, head, specific speed and power consumption) of centrifugal pump and reciprocating pump with simple numerical example. Characteristic curves of centrifugal pump and reciprocating pump, Need for priming of centrifugal pump &amp; Selection of pumps.</p>				
Case Study/Applications	Case study and practical applications of Hydraulic pumps			
Text Book	Text Book 1: 19.1, 19.2, 19.3, 19.7, 19.9 Text Book 2: 3.1, 3.2, 3.3, 3.4, 3.5			
<b>MODULE-5</b>	<b>HYDRAULIC TURBINES</b>	<b>22MEE33.4 22MEE33.5 22MEE33.6</b>	<b>8 Hours</b>	
<p><b>Hydraulic Turbines:</b> Classification, construction, Design, working principle and applications of: Pelton wheel turbine, Francis's turbine, Kaplan turbine.  <b>Performance of hydraulic turbines:</b> Geometric similarity, Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, cavitation.</p>				
Applications	Investigate the practical applications of hydraulic turbines.			
Text Book	Text Book 1: 18.1, 18.2, 18.5, 18.6, 18.8, 18.10 Text Book 2: 2.1, 2.2, 2.3, 2.4			
<b>CIE Assessment Pattern (50 Marks - Theory)</b>				
<b>RBT Levels</b>		<b>Marks Distribution</b>		
		<b>Test (s)</b>	<b>Qualitative Assessment (s)</b>	<b>MCQ's</b>
		<b>25</b>	<b>15</b>	<b>10</b>
<b>L1</b>	<b>Remember</b>	5	-	-
<b>L2</b>	<b>Understand</b>	5	-	-
<b>L3</b>	<b>Apply</b>	5	5	5
<b>L4</b>	<b>Analyze</b>	5	5	5
<b>L5</b>	<b>Evaluate</b>	5	5	-
<b>L6</b>	<b>Create</b>	-	-	-
<b>SEE Assessment Pattern (50 Marks - Theory)</b>				
<b>RBT Levels</b>		<b>Exam Marks Distribution (50)</b>		
<b>L1</b>	<b>Remember</b>	<b>10</b>		
<b>L2</b>	<b>Understand</b>	<b>10</b>		
<b>L3</b>	<b>Apply</b>	<b>10</b>		
<b>L4</b>	<b>Analyze</b>	<b>10</b>		
<b>L5</b>	<b>Evaluate</b>	<b>10</b>		
<b>L6</b>	<b>Create</b>	<b>--</b>		

**Suggested Learning Resources:****Text Books:**

- 1) Bansal R.K., "Fluid Mechanics and Hydraulic Machines", 9th edition, Laxmi Publications (P)Ltd., New Delhi, 2018.
- 2) R.K.Rajput, "A Text Book of Fluid Mechanics and Hydraulic Machines", 6th edition, S. Chand, 2015.

**Reference Books:**

- 1) Yunus A. Cengel and John M. Cimbala., 'Fluid Mechanics', McGraw Hill, 4th Edition, 2017, ISBN-(13 digits): 978-9385401374
- 2) P.N.Modi and Seth, "Fluid Mechanics and Hydraulic Machines", 22nd edition, Standard Book House, 2018.

**Web links and Video Lectures (e-Resources)**

- <https://archive.nptel.ac.in/courses/112/105/112105171/>
- <https://unacademy.com/content/gate/videos/mechanical-engineering/fluid-mechanics/#>
- <https://www.youtube.com/watch?v=clVwKynHpB0>
- <https://nptel.ac.in/courses/103102211>
- <https://nitsri.ac.in/Department/DisplayDeptPage.aspx?page=magee&ItemID=ocgkk&nDeptID=e>

**Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning**

- Visit to any Hydraulic power plant
- Demonstration on working of Pumps /Turbines
- Demonstration on Flow measuring Devices
- Contents related activities (Activity-based discussions)
  - For active participation of students, instruct the students to prepare Fluid Mechanics and Machinery related Flowcharts.
  - Organizing Group wise discussions on issues
  - Seminars



<b>FLUID MECHANICS AND MACHINERY LAB</b>														
<b>Course Code</b>	<b>22MEL33</b>							<b>CIE Marks</b>			<b>50</b>			
<b>L:T:P:S</b>	<b>0:0:1:0</b>							<b>SEE Marks</b>			<b>50</b>			
<b>Hrs / Week</b>	<b>02</b>							<b>Total Marks</b>			<b>100</b>			
<b>Credits</b>	<b>01</b>							<b>Exam Hours</b>			<b>03</b>			
<b>Course outcomes:</b>														
At the end of the course, the student will be able to:														
22MEL33.1	Apply the flow measuring devices such as Venturi meter, orifice meter and Notches to predict the coefficient of discharge for flow through pipes													
22MEL33.2	Investigate the friction and measure the frictional losses in fluid flow													
22MEL33.3	Understand the working of impact of jet on various types of vanes													
22MEL33.4	Analyze the performance of hydraulic turbine, pumps, Air blower under different working conditions													
<b>Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:</b>														
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>
22MEL33.1	3	3	3	2									3	
22MEL33.2	3	3	3	2									3	
22MEL33.3	3	3	3	2									3	
22MEL33.4	3	3	3	2									3	
<b>Exp. No. / Pgm. No.</b>	<b>List of Experiments / Programs</b>											<b>Hours</b>	<b>COs</b>	
<b>Prerequisite Experiments / Programs / Demo</b>														
	<ul style="list-style-type: none"> <li>Understand the properties of fluids</li> <li>Demonstration on pascal's law, hydrostatic law</li> <li>Demonstration on Buoyancy, determination of metacentric height.</li> </ul>											2	NA	
<b>PART-A</b>														
1	Calibration of given Venturi meter and plotting the suitable calibration curve											2	22MEL33.1	
2	Calibration of given Orifice meter and plotting the suitable calibration curve											2	22MEL33.1	
3	Calibration of given V-notch, rectangular notch and plotting the suitable calibration curve											2	22MEL33.1	
4	Determination of coefficient of friction and Chezy's constant for turbulent flow in pipes.											2	22MEL33.2	
5	Determination of minor losses coefficient in flow through pipes due to sudden contraction and sudden expansion											2	22MEL33.2	
6	Verification of Bernoulli's equation											2	22MEL33.1	
<b>PART-B</b>														
7	Determination of the impact of jet on Flat Vanes											2	22MEL33.3	
8	Determination of the impact of jet on hemispherical vanes											2	22MEL33.4	
9	Determination of the impact of jet on Inclined Vanes											2	22MEL33.4	
10	Investigate the Performance test on Pelton Wheel Turbine											2	22MEL33.4	
11	Determination of performance characteristics of centrifugal pump											2	22MEL33.4	
12	Determine the efficiency of air blower											2	22MEL33.4	

**PART-C**  
**Beyond Syllabus Virtual Lab Content**  
**(To be done during Lab but not to be included for CIE or SEE)**

- <https://fmc-nitk.vlabs.ac.in/exp/reciprocating-pump/>
- <https://fmc-nitk.vlabs.ac.in/exp/francis-turbine/>
- <https://me.iitp.ac.in/Virtual-Fluid-Laboratory/reynolds/introduction.html>
- <https://me.iitp.ac.in/Virtual-Fluid-Laboratory/pitot/introduction.html>
- <https://me.iitp.ac.in/Virtual-FluidLaboratory/metacenter/introduction.html>

**CIE Assessment Pattern (50 Marks - Lab)**

RBT Levels		Test (s)	Weekly Assessment
		20	30
L1	Remember	-	-
L2	Understand	5	5
L3	Apply	5	10
L4	Analyze	5	10
L5	Evaluate	5	5
L6	Create		

**SEE Assessment Pattern (50 Marks - Lab)**

RBT Levels		Exam Marks Distribution (50)
L1	Remember	05
L2	Understand	05
L3	Apply	10
L4	Analyze	20
L5	Evaluate	10
L6	Create	

**Suggested Learning Resources:**

**Reference Books:**

- 1) Bansal R.K., "Fluid Mechanics and Hydraulic Machines", 9th edition, Laxmi Publications (P)Ltd., New Delhi, 2018
- 2) R.K. Rajput, "A Text Book of Fluid Mechanics and Hydraulic Machines", 6th edition, S. Chand, 2015

<b>OBJECT ORIENTED PROGRAMMING USING JAVA</b>															
<b>Course Code</b>	<b>22MEE341</b>					<b>CIE Marks</b>					<b>50</b>				
<b>L:T:P:S</b>	<b>2:0:1:0</b>					<b>SEE Marks</b>					<b>50</b>				
<b>Hrs / Week</b>	<b>2+2</b>					<b>Total Marks</b>					<b>100</b>				
<b>Credits</b>	<b>03</b>					<b>Exam Hours</b>					<b>03</b>				
<b>Course outcomes:</b>															
At the end of the course, the student will be able to:															
22MEE341.1	Apply an object-oriented approach to programming and identify potential benefits of object-oriented programming over other approaches.														
22MEE341.2	Execute the concepts of classes and objects and their significance in real world														
22MEE341.3	Implement overloading concepts of function and operators														
22MEE341.4	Handle the inheritance, polymorphism and object relationship														
22MEE341.5	Reuse the code and design applications which are easier to debug, maintain and extend														
22MEE341.6	Analyze the probable error and develop a mechanism to handle it Real-time														
<b>Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:</b>															
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>	
22MEE341.1	3	-	3	-	3	-	-	-	-	-	-	2	3	-	
22MEE341.2	3	-	3	-	3	-	-	-	-	-	-	2	3	-	
22MEE341.3	3	-	3	-	3	-	-	-	-	-	-	2	3	-	
22MEE341.4	3	-	3	-	3	-	-	-	-	-	-	2	3	-	
22MEE341.5	3	-	3	-	3	-	-	-	-	-	-	2	3	-	
22MEE341.6	3	-	3	-	3	-	-	-	-	-	-	2	3	-	
<b>MODULE-1      OBJECT ORIENTED PROGRAMMING AND BASICS OF C++      22MEE341.1      9 Hours</b>															
Procedural Vs Object oriented programming, Principles of Object oriented programming, Tokens, Expressions, control structure, Functions in C++															
<b>Laboratory content:</b>															
1. Write a program to check prime number using C++															
2. Write a program for Arithmetic calculator using switch case menu..															
Self-study		Explore the Challenges of token creations, expressions													
Text Book		Text Book 1: 1.1-1.8													
<b>MODULE-2      CLASSES AND OBJECTS      22MEE341.2      9 Hours</b>															
Class, Data members and Member functions, Creating Objects of Class, Access Specifiers, Friend Functions and Friend Classes, Static Members- Constructors and Destructors, Function overloading, Operator Overloading, Overloading unary operators, overloading binary operators, overloading special operators, type conversions															
<b>Laboratory content:</b>															
3. Write a program to check prime number using C++															
4. Write a program for Arithmetic calculator using switch case menu.															
Self-study / Applications		Desirable identification of systems with classes of inputs and functions.													
Text Book		Text Book 1:5.1-5.19													
<b>MODULE-3      INHERITANCE, POLYMORPHISM, TEMPLATES AND EXCEPTION HANDLING      22MEE341.3, 22MEE341.4      9Hours</b>															

Types of inheritance, virtual base class, virtual functions, class templates, function templates, exception handling, assertions			
<b>Laboratory Components:</b>			
<ol style="list-style-type: none"> <li>5. Design a super class called Staff with details as StaffId, Name, Phone, Salary. Extend this class by writing three subclasses namely Teaching (domain, publications), Technical (skills), and Contract (period). Write a Java program to read and display at least 3 staff objects of all three categories.</li> <li>6. Write a java program demonstrating Method overloading and Constructor overloading.</li> </ol>			
Self-study	Explore the problems with inheritance.		
Text Book	Text Book 1:8.1-8.12		
<b>MODULE-4</b>	<b>INTRODUCTION TO JAVA</b>	<b>22MEE341.5</b>	<b>9 Hours</b>
Constants, variables and data types, operators, expressions, classes, objects, methods, arrays, strings and vectors, Interfaces, packages,			
<b>Laboratory Components:</b>			
<ol style="list-style-type: none"> <li>7. Write a Java program to create n Student objects and print the USN, Name, Branch, and Phone of these objects with suitable headings Create a Java class called Student with the following details as variables within it. USN, Name, Branch, Phone</li> <li>8. Write a program to perform string operations using Array List. Write functions for the following a. Append - add at end b. Insert - add at particular index c. Search d. List all string starts with given letter.</li> </ol>			
Self-study / Case Study	Explore the problems with arrays and strings.		
Text Book	Text Book 1:17.1-17.5,		
<b>MODULE-5</b>	<b>JAVA PROGRAMMING</b>	<b>22MEE341.6</b>	<b>8 Hours</b>
Multithread programming, managing errors and exceptions, Applet programming, Managing files			
<b>Laboratory Components:</b>			
<ol style="list-style-type: none"> <li>9. Write a program to generate the resume. Create 2 Java classes Teacher (data: personal information, qualification, experience, achievements) and Student (data: personal information, result, discipline) which implements the java interface Resume with the method biodata().</li> <li>10. Develop a java application to implement currency converter (Dollar to INR, EURO to INR, Yen to INR and vice versa), distance converter (meter to KM, miles to KM and vice versa), time converter (hours to minutes, seconds and vice versa) using packages.</li> <li>11. Write a Java program that implements a multi-thread application that has three threads. First thread generates a random integer for every 1 second; second thread computes the square of the number and prints; third thread will print the value of cube of the number.</li> </ol>			
Self-study / Case Study /	Explore the problems with multithread programming		
Text Book	Text Book 1: 12.1-12.7		

**CIE Assessment Pattern (50 Marks – Theory)**

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)	Lab CIE (Like SEE Lab)
		25	05	20
L1	Remember	5	-	-
L2	Understand	5	-	-
L3	Apply	5	5	5
L4	Analyze	5	-	5
L5	Evaluate	5	-	-
L6	Create	-	-	-

**SEE Assessment Pattern (50 Marks – Theory)**

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	--

**Suggested Learning Resources:**

## Text Books:

- 1) Object Oriented Programming Using C++ and Java, E Balagurusamy, 7th edition, 2017, TMH

## Reference Books:

1. C++ Primer Plus, Stephen Prata, 6th Edition, 2015, Pearson Education Limited
2. C++ PROGRAMMING Today, Barbara Johnston, 2nd Edition, 2015, Pearson Education
3. Herbert schildt (2010), The complete reference, 7th edition, Tata Mc graw Hill, New Delhi
4. Kathy Sierra and Bert Bates, Head First Java (Second Edition), O'Reilly, 2005

**Web links and Video Lectures (e-Resources):**

- <https://www.youtube.com/watch?v=MzPjHEq-MYg>
- <https://www.youtube.com/watch?v=bSrm9RXwBaI>

**Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning**

- Quizzes & Assignments
- Demonstration of daily operated program failures.
- Contents related activities (Activity-based discussions)
  - For active participation of students, instruct the students to prepare Flowcharts and Handouts
  - Organizing Group wise discussions on issues

<b>ADVANCED PYTHON PROGRAMMING</b>															
<b>Course Code</b>	<b>22MEE342</b>								<b>CIE Marks</b>	<b>50</b>					
<b>L:T:P:S</b>	<b>2:0:1:0</b>								<b>SEE Marks</b>	<b>50</b>					
<b>Hrs / Week</b>	<b>2+2</b>								<b>Total Marks</b>	<b>100</b>					
<b>Credits</b>	<b>03</b>								<b>Exam Hours</b>	<b>03</b>					
<b>Course outcomes:</b>															
At the end of the course, the student will be able to:															
22MEE342.1	Interpret the basic principles of Python programming language														
22MEE342.2	Understand the concept of Object-Oriented Programming concepts such as encapsulation, inheritance and polymorphism as used in Python														
22MEE342.3	Distinguish the commonly used operations involving file systems and regular expressions.														
22MEE342.4	Describe the semantics of Python programming language and illustrate the process of structuring the data using lists, dictionaries, tuples, strings and sets.														
22MEE342.5	Implement Machine Learning algorithms														
22MEE342.6	Apply the necessary Python libraries for implementing Machine Learning models														
<b>Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:</b>															
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>	
22MEE342.1	3	3	2	-	-	-	-	-	-	-	-	2	3	-	
22MEE342.2	3	3	2	-	-	-	-	-	-	-	-	2	3	-	
22MEE342.3	3	3	2	-	-	-	-	-	-	-	-	2	3	-	
22MEE342.4	3	3	2	-	-	-	-	-	-	-	-	2	3	-	
22MEE342.5	3	3	2	-	-	-	-	-	-	-	-	2	3	-	
22MEE342.6	3	3	2	-	-	-	-	-	-	-	-	2	3	-	
<b>MODULE-1 Introduction to Python</b>															
										<b>22MEE342.1</b>	<b>8 Hours</b>				
use IDLE to develop programs, Basic coding skills, working with data types and variables, working with numeric data, working with string data, Python functions, Boolean expressions, selection structure, iteration structure, working with lists, work with a list of lists, work with tuples, work with dates and times, get started with dictionaries															
<b>Laboratory content:</b>															
1. Create a list and perform the following methods 1) insert() 2) remove() 3) append() 4) len() 5) pop() 6) clear() 2. Create a dictionary and apply the following methods 1) Print the dictionary items 2) access items 3) use get() 4) change values 5) use len() 3. Create a tuple and perform the following methods 1) Add items 2) len() 3) check for item in tuple 4) Access items															
Case Study / Applications	Solve, test and debug basic problems using python script.														
Text Book:	Text Book 1 & 2: Section 1-3														
<b>MODULE-2 Classes in Python:</b>															
										<b>22MEE342.2</b>	<b>8 Hours</b>				
OOPS Concepts, Classes and objects , Classes in Python, Constructors, Data hiding, Creating Classes, Instance Methods, Special Methods, Class Variables, Inheritance, Polymorphism, Type Identification, Custom Exception Classes, Iterators, generators and decorators.															
<b>Laboratory Content:</b>															
4. Write a python program to print a number is positive/negative using if-else 5. Write a python program to find largest number among three numbers. 6. Write a python Program to read a number and display corresponding day using if_elif_else?															
Case Study / Applications	Design object-oriented programs with Python classes														

Text Book:	Text Book 1 & 2: Section 4-6		
<b>MODULE-3</b>	<b>I/O and Error Handling In Python :</b>	<b>22MEE342.3</b>	<b>8 Hours</b>
Introduction, Data Streams, Creating Your Own Data Streams, Access Modes, Writing Data to a File, Reading Data From a File, Additional File Methods, Handling IO Exceptions, Errors, Run Time Errors, The Exception Model, Exception Hierarchy, Handling Multiple Exceptions, Working with Directories.			
<b>Laboratory Components:</b>			
7. Write a python program to print date, time for today and now.			
8. Write a python program to add some days to your present date and print the date added.			
9. Write a python program which accepts the radius of a circle from user and computes the area (use math module)			
Case Study / Applications	Identify the commonly used operation involved in files for I/O processing		
Text Book	Text Book 1 & 2: Section 7-11		
<b>MODULE-4</b>	<b>An Introduction to relational databases:</b>	<b>22MEE342.4</b>	<b>8 Hours</b>
SQL statements for data manipulation, Using SQLite Manager to work with a database, Using Python to work with a database, Creating a GUI that handles an event, working with components.			
<b>Laboratory Components:</b>			
10. Write a python program to create a package (college), sub -package (alldept), modules(it,cse) and create admin and cabin function to module?			
11. e admin and cabin function to module? 2 B) Write a python program to create a package (Engg), sub -package( years), modules (sem) and create staff and student function to module?			
12. Write a python Program to display welcome to NHCE by using classes and objects.			
Case Study / Applications	Determination of the screw diameters, pitch of power screws used in lathe machines and UTM		
Text Book	Text Book 1 & 2: Section 12-14		
<b>MODULE-5</b>	<b>Implement Machine Learning algorithms:</b>	<b>22MEE342.5</b> <b>22MEE342.6</b>	<b>8 Hours</b>
Usage of Numpy for numerical Data, Usage of Pandas for Data Analysis, Matplotlib for Python plotting, Seaborn for Statical plots, interactive Dynamic visualizations, SciKit for Machine learning.			
<b>Laboratory Components:</b>			
13. Using a numpy module create an array and check the following: 1. Type of array 2. Axes of array 3. Shape of array 4. Type of elements in array			
Case Study / Applications	Understand the advantage of using Python libraries for implementing Machine Learning models.		
Text Book	Text Book 1 & 2: Section 15-16		

<b>CIE Assessment Pattern (50 Marks - Theory and Lab)</b>				
<b>RBT Levels</b>		<b>Marks Distribution</b>		
		<b>Test (s)</b>	<b>Qualitative Assessment (s)</b>	<b>Lab CIE (Like SEE Lab)</b>
		<b>25</b>	<b>5</b>	<b>20</b>
<b>L1</b>	<b>Remember</b>	5	-	-
<b>L2</b>	<b>Understand</b>	5	-	-
<b>L3</b>	<b>Apply</b>	5	5	10
<b>L4</b>	<b>Analyze</b>	5	-	10
<b>L5</b>	<b>Evaluate</b>	5	-	-
<b>L6</b>	<b>Create</b>	-	-	-

<b>SEE Assessment Pattern (50 Marks - Theory)</b>		
<b>RBT Levels</b>		<b>Exam Marks Distribution (50)</b>
<b>L1</b>	<b>Remember</b>	<b>10</b>
<b>L2</b>	<b>Understand</b>	<b>10</b>
<b>L3</b>	<b>Apply</b>	<b>10</b>
<b>L4</b>	<b>Analyze</b>	<b>10</b>
<b>L5</b>	<b>Evaluate</b>	<b>10</b>
<b>L6</b>	<b>Create</b>	<b>--</b>

**Suggested Learning Resources:**

**Text Books:**

1. Python Programming, Michael Urban and Joel Murach, Shroff/Murach, 2016, Shroff/Murach; First Edition (1 January 2017), ISBN-13 : 978-9352134922

**Reference Books:**

1. Fundamental of python programming, Richard L Halterman, Createspace Independent Pub (26 October 2016), ISBN-13 : 978-1539530268

**Web links and Video Lectures (e-Resources):**

- <https://www.w3schools.com/python>
- <https://docs.python.org/3/tutorial/index.html>
- [https://www.python-course.eu/advanced\\_topics.php](https://www.python-course.eu/advanced_topics.php)

**Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning**

- Data identification from external resources like Kaggle and other online data base.
- Interpretation of data into .csv file
- Creating the GUI
- Building the interface using opensource softwares like eclipse or Apachenetbean
- Integration of the data with the GUI from MySQL



<b>INTRODUCTION TO ARTIFICIAL INTELLIGENCE</b>														
<b>Course Code</b>	<b>22MEE343</b>				<b>CIE Marks</b>				<b>50</b>					
<b>L:T:P:S</b>	<b>2:0:1:0</b>				<b>SEE Marks</b>				<b>50</b>					
<b>Hrs / Week</b>	<b>2+2</b>				<b>Total Marks</b>				<b>100</b>					
<b>Credits</b>	<b>03</b>				<b>Exam Hours</b>				<b>03</b>					
<b>Course outcomes:</b>														
At the end of the course, the student will be able to:														
22MEE343.1	Describe basic AI methods, problem solving and foundations of AI.													
22 MEE343.2	Apply basic principles of AI that involves inference, perception, knowledge representation and learning. Understand the Search techniques and Heuristics approaches in AI.													
22 MEE343.3	Understand the knowledge representation concepts in AI													
22 MEE343.4	Analyze the Learning systems and Expert systems.													
22 MEE343.5	Illustrate the AI programming language.													
22 MEE343.6	Understand the techniques involved and the various numeric functions.													
<b>Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:</b>														
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>
22MEE343.1	3	3	3	3	2	-	-	-	1	1	-	2	3	3
22 MEE343.2	3	3	3	3	2	-	-	-	1	1	-	2	3	3
22 MEE343.3	3	3	3	3	2	-	-	-	1	1	-	2	3	3
22 MEE343.4	3	3	3	3	2	-	-	-	1	1	-	2	3	3
22 MEE343.5	3	3	3	3	2	-	-	-	1	1	-	2	3	3
22 MEE343.6	3	3	3	3	2	-	-	-	1	1	-	2	3	3
<b>MODULE-1 INTRODUCTION TO AI</b> <span style="float: right;"><b>22MEE343.1</b> <b>8 Hours</b></span>														
Importance of AI, Evolution of AI, Applications of AI, Classification of AI Systems, Knowledge Inferring Systems and Planning.														
<b>Laboratory Component: (minimum 3 experiments / programs)</b>														
1. Python program to print "Hello World!!!"														
2. Python Program to find the square root.														
3. Python Program to calculate the area of the triangle.														
Case Study		Problems related to basic python programming												
Text Book		Text Book 1: 1.1, 1.2, 1.3, 1.4, 1.5												
<b>MODULE-2 PROBLEM SOLVING WITH AI</b> <span style="float: right;"><b>22MEE343.2</b> <b>8 Hours</b></span>														
Problem solving by Search- Uninformed search strategies, Informed search strategies, Problem Space- State Space, Blind Search Types.														
<b>Heuristic Functions:</b> Types, Generate and Test, Hill Climbing, Game Playing with mini-max algorithm, Alpha-Beta pruning, Best First Search.														
<b>Laboratory Component:</b>														
1. Bill Vs Tip														
2. House Price Prediction														
3. Salary Prediction														
4. Student Score Prediction														
Case Study		Basic AI Programming												
Text Book		Text Book 1: 3.2, 18.1, 18.2												

<b>MODULE-3</b>	<b>KNOWLEDGE REPRESENTATION</b>	<b>22MEE343.3</b>	<b>8 Hours</b>	
Logical systems, knowledge-based systems, Issues in knowledge representation, Propositional Vs Predicate logic, Procedural Vs Declarative knowledge.				
<b>Laboratory Component:</b>				
<ol style="list-style-type: none"> <li>1. House price prediction</li> <li>2. Salary prediction</li> <li>3. Advertising</li> </ol>				
Case Study	Basic AI Programming Examples			
Text Book	Text Book 1: 7.1, 7.4, 7.5, 7.6, 7.7			
<b>MODULE-4</b>	<b>LEARNING SYSTEMS AND EXPERT SYSTEMS</b>	<b>22MEE343.4</b>	<b>8 Hours</b>	
<b>Learning Systems:</b> Supervised, Unsupervised, Reinforcement Learning, Decision Trees, Probability and Bayes' Theorem, Bayesian networks.				
<b>Expert Systems:</b> Stages, Tools, Probability based ES, Difficulties of ES, Applications of ES.				
<b>Laboratory Component:</b>				
<ol style="list-style-type: none"> <li>1. Insurance Prediction</li> <li>2. HR Analytics</li> </ol>				
Case Study	Probability and Bayesian network Example Problems			
Text Book	Text Book: 3.4, 3.5, 3.6, 3.7			
<b>MODULE-5</b>	<b>AI PROGRAMMING LANGUAGES</b>	<b>22MEE343.5, 22MEE343.6</b>	<b>8 Hours</b>	
<b>AI Programming Language:</b> Introduction to PROLOG and LISP, Programming Techniques, Syntax and Numeric Functions, Predicates and Conditionals, List Manipulation, Redundancy and Termination, Iteration and Recursion. Future of AI.				
<b>Laboratory Component:</b>				
<ol style="list-style-type: none"> <li>1. Titanic Data Set</li> <li>2. Comcast Data Set</li> <li>3. Mercedes Benz Data Set</li> </ol>				
Case Study	Example Problems on AI Programming Languages			
Text Book	Text Book 1: 18, 19, 27.1-27.4			
<b>CIE Assessment Pattern (50 Marks – Theory and Lab)</b>				
		<b>Marks Distribution</b>		
<b>RBT Levels</b>		<b>Test (s)</b>	<b>Qualitative Assessment</b>	<b>Lab</b>
		<b>25</b>	<b>15</b>	<b>10</b>
<b>L1</b>	<b>Remember</b>	5	-	-
<b>L2</b>	<b>Understand</b>	5	-	-
<b>L3</b>	<b>Apply</b>	5	5	5
<b>L4</b>	<b>Analyze</b>	5	5	5

	<b>L5</b>	<b>Evaluate</b>	5	5	-																						
	<b>L6</b>	<b>Create</b>	-	-	-																						
<b>SEE Assessment Pattern (50 Marks – Theory)</b>																											
<table border="1"> <thead> <tr> <th colspan="2">RBT Levels</th> <th>Exam Marks Distribution (50)</th> </tr> </thead> <tbody> <tr> <td><b>L1</b></td> <td><b>Remember</b></td> <td><b>10</b></td> </tr> <tr> <td><b>L2</b></td> <td><b>Understand</b></td> <td><b>10</b></td> </tr> <tr> <td><b>L3</b></td> <td><b>Apply</b></td> <td><b>10</b></td> </tr> <tr> <td><b>L4</b></td> <td><b>Analyze</b></td> <td><b>10</b></td> </tr> <tr> <td><b>L5</b></td> <td><b>Evaluate</b></td> <td><b>10</b></td> </tr> <tr> <td><b>L6</b></td> <td><b>Create</b></td> <td><b>--</b></td> </tr> </tbody> </table>							RBT Levels		Exam Marks Distribution (50)	<b>L1</b>	<b>Remember</b>	<b>10</b>	<b>L2</b>	<b>Understand</b>	<b>10</b>	<b>L3</b>	<b>Apply</b>	<b>10</b>	<b>L4</b>	<b>Analyze</b>	<b>10</b>	<b>L5</b>	<b>Evaluate</b>	<b>10</b>	<b>L6</b>	<b>Create</b>	<b>--</b>
RBT Levels		Exam Marks Distribution (50)																									
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<b>L2</b>	<b>Understand</b>	<b>10</b>																									
<b>L3</b>	<b>Apply</b>	<b>10</b>																									
<b>L4</b>	<b>Analyze</b>	<b>10</b>																									
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<b>L6</b>	<b>Create</b>	<b>--</b>																									
<b>Suggested Learning Resources:</b>																											
<b>Text Books:</b>																											
<ol style="list-style-type: none"> <li>1) “Artificial intelligence – A Modern Approach” By S. J. Russell, 2010, Pearson Education, Inc..</li> <li>2) “Artificial Intelligence” By E. Rich, K. Knight, and S. Nair, 2009, Tata McGraw Hill.</li> </ol>																											
<b>Reference Books:</b>																											
<ol style="list-style-type: none"> <li>1) “Artificial intelligence and intelligent systems”, By N. P. Padhy, 2005. (Vol. 337). Oxford: Oxford University Press.</li> <li>2) “Artificial Intelligence: Structures and Strategies for Complex Problem Solving”, G. Luger, 2008. 6th Addison Wesley.</li> </ol>																											
<b>Web links and Video Lectures (e-Resources):</b>																											
<ul style="list-style-type: none"> <li>• <a href="https://www.geeksforgeeks.org/artificial-intelligence-an-introduction/">https://www.geeksforgeeks.org/artificial-intelligence-an-introduction/</a></li> <li>• <a href="https://nptel.ac.in/courses/106102220">https://nptel.ac.in/courses/106102220</a></li> <li>• <a href="https://onlinecourses.nptel.ac.in/noc23_ge40/preview">https://onlinecourses.nptel.ac.in/noc23_ge40/preview</a></li> <li>• <a href="https://onlinecourses.nptel.ac.in/noc23_cs92/preview">https://onlinecourses.nptel.ac.in/noc23_cs92/preview</a></li> </ul>																											
<b>Activity-Based Learning (Suggested Activities in Class)/ Practical Based Learning</b>																											
<ul style="list-style-type: none"> <li>• Visit to Robotics/AI Industry</li> <li>• Video demonstration of latest trends in mobility/robotics</li> <li>• Contents related activities (Activity-based discussions) – <ul style="list-style-type: none"> <li>➤ Supervised/Unsupervised Learning, Reinforcement Learning</li> </ul> </li> </ul>																											

<b>EXPLORATORY DATA ANALYSIS USING MODERN TOOLS</b>															
<b>Course Code</b>	<b>22MEE344</b>					<b>CIE Marks</b>					<b>50</b>				
<b>L:T:P:S</b>	<b>2:0:1:0</b>					<b>SEE Marks</b>					<b>50</b>				
<b>Hrs / Week</b>	<b>2+2</b>					<b>Total Marks</b>					<b>100</b>				
<b>Credits</b>	<b>03</b>					<b>Exam Hours</b>					<b>03</b>				
<b>Course outcomes:</b>															
At the end of the course, the student will be able to:															
22MEE344.1	Understand the concept of Data														
22MEE344.2	Remember the steps involved in interpreting the data using programming skills														
22MEE344.3	Understand the tools used for data visualization														
22MEE344.4	Understand the process to perform exploratory data analysis using fundamental skills														
22MEE344.5	Evaluate the results based on the EDA algorithms														
22MEE344.6	Understand data engineering														
<b>Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:</b>															
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>	
22MEE344.1	3	-	3	-	3	-	-	-	-	-	-	2	3	-	
22MEE344.2	3	-	3	-	3	-	-	-	-	-	-	2	3	-	
22MEE344.3	3	-	3	-	3	-	-	-	-	-	-	2	3	-	
22MEE344.4	3	-	3	-	3	-	-	-	-	-	-	2	3	-	
22MEE344.5	3	-	3	-	3	-	-	-	-	-	-	2	3	-	
22MEE344.6	3	-	3	-	3	-	-	-	-	-	-	2	3	-	
<b>MODULE-1 Introduction: Data science</b>															
										<b>22MEE344.1</b>		<b>8 Hours</b>			
										<b>22MEE344.2</b>					
Introduction: What is Data Science? Big Data and Data Science hype – and getting past the hype, Why now? – Datafication, Current landscape of perspectives, A data Science Profile, Skill sets. Statistical Inference, Populations and samples, Big Data, new kinds of data, modelling, statistical modeling probability distributions, fitting a model, - Introduction to R															
<b>Laboratory content:</b>															
1. Determine the use of filtering operation for the given data set.															
2. Find the quantity of the given conditions within the given data set using sorting techniques.															
3. Analyse the given data for NAN values and further discrepancy: Census Data															
Case Study / Applications	Stats Data sample analysis using Excel														
Text Book:	Text Book 1 & 2: Section 4 (EDA)														
<b>MODULE-2 EDA – Introduction</b>															
										<b>22MEE344.3</b>		<b>8 Hours</b>			
										<b>22MEE344.4</b>					
										<b>22MEE344.5</b>					
Exploratory Data Analysis and the Data Science Process: Basic tools (plots, graphs and summary statistics) of EDA, Philosophy of EDA, The Data Science Process, Case Study: RealDirect (online real estate firm). Algorithms, machine Learning Algorithms,															
<b>Laboratory content:</b>															
4. Write a program for data visualization for the given data set using python.															
5. Write a program to fix the rows and columns, missing values, standard values.															
6. Perform univariate analysis for the given data.															
Case Study / Applications	Case study: Titanic data set (source: Github)														

Text Book:	Text Book 1 & 2: Section 4 (EDA)			
<b>MODULE-3</b>	<b>EDA – Approach in problem solving</b>	<b>22MEE344.3 22MEE344.4 22MEE344.5</b>	<b>8 Hours</b>	
Spam Filter, Linear Regression and Spam Filter, K-NN and spam Filter,, Naïve Bayes Algorithm, Spam Filter using Naïve Bayes, Laplace Smoothing,, Comparing Naïve Bayes to K-NN, Scraping the Web, introduction to Logical Regression and M6D case study				
<b>Laboratory content:</b>				
7. Write a program to perform the linear regression for the given dataset.				
8. Write a program to perform the Naïve Bayes analysis for the given dataset – Spam or Ham				
9. Perform univariate analysis for the given data set – spam or ham				
Case Study / Applications	Case study: Model selection (Lending club, source: Github)			
Text Book	Text Book 1 & 2: Section 4 (EDA)			
<b>MODULE-4</b>	<b>EDA – Algorithm</b>	<b>22MEE344.3</b>	<b>8 Hours</b>	
Three Basic Algorithms: Linear Regression, k-Nearest Neighbours (kNN), k-means, R Programs for the algorithms				
<b>Laboratory content:</b>				
10. Write a program to perform the linear regression for the given dataset.				
11. Perform Bivariate analysis for the given data set				
Case Study / Applications	Case study: Telecom churn (Source: Github)			
Text Book	Text Book 1 & 2: Section 4 (EDA)			
<b>MODULE-5</b>	<b>Data Engineering</b>	<b>22MEE344.6</b>	<b>8 Hours</b>	
Data Engineering, Map reduce, Word Frequency Problem,, Map Reduce Solution, Other Examples of Map Reduce, Pregel-An Introduction. Data Visualization: Basic principles, ideas and tools for data visualization. Mining SocialNetwork Graphs: Social networks as graphs, Clustering of graphs, Direct discovery of communities in graphs, Partitioning 2 of graphs				
<b>Laboratory content:</b>				
12. Perform Bivariate analysis for the given data set: Telecom Churn				
Case Study / Applications	Case study: Advanced Excel for data analytics			
Text Book	Text Book 1 & 2: Section 4 (EDA)			
<b>CIE Assessment Pattern (50 Marks – Theory and Lab)</b>				
<b>RBT Levels</b>		<b>Marks Distribution</b>		
		<b>Test (s)</b>	<b>Qualitative Assessment (s)</b>	<b>Lab CIE (Like SEE Lab)</b>
		<b>25</b>	<b>05</b>	<b>20</b>
<b>L1</b>	<b>Remember</b>	5	-	-
<b>L2</b>	<b>Understand</b>	5	-	-
<b>L3</b>	<b>Apply</b>	5	5	10
<b>L4</b>	<b>Analyze</b>	5	-	10
<b>L5</b>	<b>Evaluate</b>	5	-	-
<b>L6</b>	<b>Create</b>	-	-	-

**SEE Assessment Pattern (50 Marks - Theory)**

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	--

**Suggested Learning Resources:****Text Books:**

1. Cathy O Neil, Rachel Schutt, 2014, "Doing Data Science-Straight Talk from the Frontline", Orielly
2. Jure Leskovek, Anand Rajaraman, Jeffrey Ullman, 2014 Mining of Massive Data Sets, Cambridge University Press

**Reference Books:**

1. Kevin Murphy, 2013, Machine learning: A Probabalistic Perspective,
2. Peter Bruce, Andre Bruce, Practical Statistics for Data Scientists, Orielly Series

**Web links and Video Lectures (e-Resources):**

- <https://www.youtube.com/watch?v=q4pyaVZjqk0>
- <https://www.stat.cmu.edu/~hseltman/309/Book/chapter4.pdf>

**Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning**

- Data identification from external resources like Kaggle and other online data base.
- Interpretation of data into .csv file
- Data engineering and visualization (Telecom churn: Naïve bayes)
- Data analysis and model building (Telecom churn: Naïve bayes)
- Model validation for test and train data (Telecom churn: Naïve bayes)

<b>COMPUTER AIDED MACHINE DRAWING</b>														
<b>Course Code</b>	<b>22MEE351</b>								<b>CIE Marks</b>			<b>50</b>		
<b>L:T:P:S</b>	<b>0:0:1:0</b>								<b>SEE Marks</b>			<b>50</b>		
<b>Hrs / Week</b>	<b>02</b>								<b>Total Marks</b>			<b>100</b>		
<b>Credits</b>	<b>01</b>								<b>Exam Hours</b>			<b>03</b>		
<b>Course outcomes:</b>														
At the end of the course, the student will be able to:														
22MEE351.1	Understand the orientation and sections of solids in different views.													
22MEE351.2	Familiarize the students with Indian Standards on drawing practices, production of 2 D drawings.													
22MEE351.3	Relate the limits, fits and tolerance on component dimensions along with GD&T.													
22MEE351.4	Impart knowledge on 3D surface models using CAD software.													
<b>Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:</b>														
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>
22MEE351.1	3	2	-	-	2	-	-	-	-	2	-	2	2	2
22MEE351.2	3	2	-	-	2	-	-	-	-	2	-	2	2	2
22MEE351.3	3	-	-	-	-	-	-	-	-	2	-	2	2	2
22MEE351.4	3	2	2	-	2	-	-	-	-	2	-	2	2	2
<b>Exp. No.</b>	<b>List of Experiments</b>											<b>Hours</b>	<b>COs</b>	
<b>Prerequisite Experiments / Programs / Demo</b>														
	<ul style="list-style-type: none"> <li>Automation and Robotics</li> <li>Computer Aided Engineering Drawing</li> </ul>											2	NA	
<b>PART-A</b>														
1	Introductions to Sections of Solids											2	22MEE351.1	
2	Sections of Pyramids, Prisms resting only on their bases and their true shapes											2	22MEE351.1	
3	Sections of Tetrahedrons, Cones and Cylinders resting only on their bases and their true shapes											2	22MEE351.1	
4	Introduction to limits, fits and tolerances											2	22MEE351.2	
5	Introduction to dimensional and geometric tolerances											2	22MEE351.2	
6	Introduction to surface finish symbols											2	22MEE351.2	
<b>PART-B</b>														
7	Introduction to Surface Modeling											2	22MEE351.3,4	
8	Generation of 3D sheet metal component: Tray, Brackets, Funnel, Belt Guards, Air filters, Housings, Transition Pieces etc.											2	22MEE351.3,4	
9	Introduction to Solid Modeling (Assembly Drawings)											2	22MEE351.3,4	
10	Parts Modeling and assembly of Screw jack (Bottle type)											2	22MEE351.3,4	
11	Parts Modeling and assembly of Plummer block (Pedestal Bearing)											2	22MEE351.3,4	
12	Parts Modeling and assembly of Machine vice											2	22MEE351.3,4	
<b>PART-C</b>														
<ul style="list-style-type: none"> <li><a href="https://kdm-iitkgp.vlabs.ac.in/exp/simple-drawing-board/theory.html">https://kdm-iitkgp.vlabs.ac.in/exp/simple-drawing-board/theory.html</a></li> <li><a href="https://dom-nitk.vlabs.ac.in/exp/slider-crank-mechanism/procedure.html">https://dom-nitk.vlabs.ac.in/exp/slider-crank-mechanism/procedure.html</a></li> </ul>														

**CIE Assessment Pattern (50 Marks – Lab)**

RBT Levels		Test (s)	Weekly Assessment
		20	30
L1	Remember	-	-
L2	Understand	5	5
L3	Apply	5	10
L4	Analyze	5	5
L5	Evaluate	5	10
L6	Create		

**SEE Assessment Pattern (50 Marks – Lab)**

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	10
L3	Apply	10
L4	Analyze	20
L5	Evaluate	10
L6	Create	

**Suggested Learning Resources:****Reference Books:**

- 1) 'Machine Drawing', K.R. Gopala Krishna, Subhash Publication, 2017, ISBN-139789383214235
- 2) 'Machine Drawing' N. D. Bhat, V M Panchal, Charotar Publication House, 2014, ISBN: 9789385039232, 9385039237
- 3) Advanced Surface Modeling in Matrixgold, Mohsen Mohammadvali



<b>EXCEL IN MS EXCEL</b>															
<b>Course Code</b>	<b>22MEE352</b>										<b>CIE Marks</b>	<b>50</b>			
<b>L:T:P:S</b>	<b>1:0:0:0</b>										<b>SEE Marks</b>	<b>50</b>			
<b>Hrs / Week</b>	<b>01</b>										<b>Total Marks</b>	<b>100</b>			
<b>Credits</b>	<b>01</b>										<b>Exam Hours</b>	<b>02</b>			
<b>Course outcomes:</b>															
At the end of the course, the student will be able to:															
22MEE352.1	Understand the basic skill relevant to various industries and techniques that are applicable across the industry sector.														
22MEE352.2	Acquire the data analysis skill techniques through real life case study.														
22MEE352.3	Explore the work data sheet for multi-source located in VLOOKUP, XLOOKUP and HLOOKUP development.														
22MEE352.4	Study on the different types of charts and graphics techniques, to format tables and dynamics pivot charts.														
<b>Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:</b>															
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PS01</b>	<b>PS02</b>	
22MEE352.1	3	3	3	3	2	-	-	-	-	-	-	-	3	3	
22MEE352.2	3	3	3	3	2	-	-	-	-	-	-	-	3	3	
22MEE352.3	3	3	3	3	2	-	-	-	-	-	-	-	3	3	
22MEE352.4	3	3	3	3	2	-	-	-	-	-	-	-	3	3	
<b>MODULE-1</b>	<b>Create Worksheets and Workbooks</b>										<b>22MEE352.1</b>	<b>3 Hours</b>			
Create workbooks, Modify workbooks. Modify worksheets, Merge and unmerge cells. Customize the Excel app window, Manage the ribbon, and Manage the Quick Access Toolbar, Customize the status bar. Change the magnification level of a worksheet, Arrange multiple workbook windows, Skills review, Practice tasks. Work with data and Excel tables Enter and revise data, Manage data by using Flash Fill, Move data within a workbook, Sidebar: Quickly access data-formatting commands, Find and replace data, Correct and fine-tune data, Define Excel tables, Skills review, Practice tasks															
Self-study / Case Study / Applications		Applications : To study the Worksheets and Workbooks, and data formatting, Practice tasks which is used in various fields													
Text Book		Text Book 1 :3 to 39 and 41 to 68													
<b>MODULE-2</b>	<b>Perform calculations on data</b>										<b>22MEE352.2</b>	<b>3 Hours</b>			
Name data ranges. Create formulas to calculate values. Summarize data that meets specific conditions. Copy and move formulas. Create array formulas. Find and correct errors in calculations. Configure automatic and iterative calculation options. Change workbook appearance Format cells, Define and manage cell styles , Apply and modify workbook themes , Apply and modify table styles , Make numbers easier to read , Change the appearance of data based on its value ,Add images to worksheets .															
Self-study / Case Study / Applications		Applications : To Find and correct errors in calculations and Configure automatic and iterative calculation options													
Text Book		Text Book 1 : 71 to 133													
<b>MODULE-3</b>	<b>Analyze and present data</b>										<b>22MEE352.3</b>	<b>3 Hours</b>			
Manage worksheet data, Filter data ranges and tables, Summarize filtered data, Sidebar: Randomly select list rows, Enforce data entry criteria. Reorder and summarize data, Sort worksheet data, Sort data by using custom, lists Outline and subtotal data. Combine data from multiple sources, Look up data from other locations , Locate information in the same row (VLOOKUP) , Locate information in the same column (HLOOKUP) , Locate information anywhere (XLOOKUP) , Link to data in other locations , Consolidate multiple sets of data .															

Self-study / Case Study / Applications	Applications: To Investigate the various Multi-source located in VLOOKUP, XLOOKUP and HLOOKUP development.			
Text Book	Text Book 1: 137 to 191			
<b>MODULE-4</b>	<b>Analyze alternative data sets</b>	<b>22MEE352.4,</b>	<b>3 Hours</b>	
Analyze alternative data sets, Define and display alternative data sets, Forecast data by using data tables, Identify the input necessary to achieve a specific result. Create charts and graphics , Create standard charts , Create combo charts , Create specialized charts , Hierarchy charts , Statistic charts , Scatter charts , Stock charts , Map charts, Customize chart appearance , Identify data trends , Summarize data by using spark lines , Illustrate processes and relationships, ix Insert and manage shapes , Sidebar: Insert mathematical equations. Create PivotTables and Pivot Charts, Analyze data dynamically in PivotTables, Filter, show, and hide PivotTable data, Edit Pivot Tables, Format PivotTables and Create dynamic Pivot Charts.				
Self-study / Case Study / Applications	Applications: To get knowledge of practicing the charts, tables and graphs which is used in various fields.			
Text Book	Text Book 1: 194 to 277			
<b>MODULE-5</b>	<b>Collaborate and share in Excel</b>	<b>22MEE352.5, 22MEE352.6</b>	<b>3 Hours</b>	
Print worksheets and charts ,Add headers and footers to printed pages ,Prepare worksheets for printing , Fit your worksheet contents to the printed page , Change page breaks in a worksheet , Change the page printing order for worksheets , Print worksheets , Print parts of worksheets ,Print charts. Automate tasks and input , Enable and examine macros, Set macro security levels in Excel , Examine macros , Create and modify macros, Run macros , Assign a macro to a Quick Access Toolbar button , Assign a macro to a shape , Run a macro when a workbook opens , Present information and options as form controls Work with other Microsoft 365 apps , Combine Excel, Word, and PowerPoint content , Link from Excel to a document or presentation , Embed file content , Create hyperlinks from worksheets.				
Self-study / Case Study / Applications	Application: To Create hyperlinks from worksheets.			
Text Book	Text Book 1: 285 to 346			
<b>CIE Assessment Pattern (50 Marks - Theory)</b>				
<b>RBT Levels</b>		<b>Marks Distribution</b>		
		<b>Test (s)</b>	<b>Qualitative Assessment (s)</b>	<b>MCQ's</b>
		<b>25</b>	<b>15</b>	<b>10</b>
<b>L1</b>	<b>Remember</b>	5	-	-
<b>L2</b>	<b>Understand</b>	5	-	-
<b>L3</b>	<b>Apply</b>	5	5	5
<b>L4</b>	<b>Analyze</b>	5	5	5
<b>L5</b>	<b>Evaluate</b>	5	5	-
<b>L6</b>	<b>Create</b>		-	-
<b>SEE Assessment Pattern (50 Marks - Theory)</b>				
<b>RBT Levels</b>		<b>Exam Marks Distribution (50)</b>		
<b>L1</b>	<b>Remember</b>	10		
<b>L2</b>	<b>Understand</b>	10		
<b>L3</b>	<b>Apply</b>	10		
<b>L4</b>	<b>Analyze</b>	10		
<b>L5</b>	<b>Evaluate</b>	10		
<b>L6</b>	<b>Create</b>	--		

**Suggested Learning Resources:****Text Books:**

- 1) Microsoft Excel Step by Step (Office 2021 and Microsoft 365) 'Joan Lambert Curtis Frye' ISBN-13: 978-0-13-756427-9 Pearson Education, Inc.
- 2) Advanced Excel Formulas 'Alan Murray' 978-1-4842-7125-4 Published: 28 August 2022
- 3) Microsoft Excel 2019: Data Analysis And Business Modelling 'Wayne L. Winston'

**Reference Books:**

- 1) Excel Formulas and Functions: Cool Tips and Tricks with Formulas in Excel

**Web links and Video Lectures (e-Resources):**

<https://www.youtube.com/watch?v=RkQl2wVpQAo>

[https://www.youtube.com/watch?v=8Ob8Hre\\_SnI](https://www.youtube.com/watch?v=8Ob8Hre_SnI)

<https://learn.microsoft.com/en-us/power-pages/getting-started/tutorial-add-custom-page-layout>

**Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning**

- Demonstration of excel operations
- Demonstration of Create charts and graphics
- Demonstration of Change workbook appearance
- Video demonstration of latest trends in mobility
- Contents related activities (Activity-based discussions)
  - For active participation of students, instruct the students to prepare Flowcharts and Handouts
  - Organizing Group wise discussions on issues
  - Seminars

<b>TOOL ENGINEERING</b>														
<b>Course Code</b>	<b>22MEE353</b>					<b>CIE Marks</b>					<b>50</b>			
<b>L:T:P:S</b>	<b>1:0:0:0</b>					<b>SEE Marks</b>					<b>50</b>			
<b>Hrs / Week</b>	<b>01</b>					<b>Total Marks</b>					<b>100</b>			
<b>Credits</b>	<b>01</b>					<b>Exam Hours</b>					<b>02</b>			
<b>Course outcomes:</b>														
At the end of the course, the student will be able to:														
22MEE353.1	Understand the basics concepts of Injection mould design.													
22MEE353.2	Apply knowledge in Compression mold design.													
22MEE353.3	Understand the techniques and the essential parts for the molds.													
22MEE353.4	Remember the fundamentals of press tool design.													
<b>Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:</b>														
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>
22MEE353.1	3	-	-	-	-	-	-	-	-	-	-	3	3	3
22MEE353.2	3	-	-	-	-	-	-	-	-	-	-	3	3	3
22MEE353.3	3	3	-	-	-	-	-	-	-	-	-	3	3	3
22MEE353.4	3	3	-	-	-	-	-	-	-	-	-	3	3	3
<b>MODULE-1</b>	<b>INJECTION MOULDING</b>					<b>22MEE353.1</b>					<b>3 Hours</b>			
						<b>22MEE353.3</b>								
						<b>22MEE353.6</b>								
Plastics product design Concepts, factors, process variables, product design. Uniform and symmetrical wall thickness, Draft angle Rib & Radius Bosses Holes, metal inserts parting line Tolerances.														
Self-study / Case Study / Applications		Injection Moulding areas of industrial applications.												
Text Book		Text Book 1: 1.1, 1.2, 1.3, 1.4, 1.5												
<b>MODULE-2</b>	<b>GENERAL MOLUDING CONSTRUCTION</b>					<b>22MEE353.1</b>					<b>3 Hours</b>			
						<b>22MEE353.3</b>								
						<b>22MEE353.6</b>								
Introduction , Mold design concepts, mold elements parting line and parting surface construction of core and cavities Bolsters mold alignment, Feed system, Sprue, runner, gate & position of gate runner & gate balancing.														
Self-study / Case Study / Applications		Moulding construction case study.												
Text Book		Text Book 1: 2.1, 2.2, 2.3, 2.4, 2.5												
<b>MODULE-3</b>	<b>COMPRESSION MOULDING</b>					<b>22MEE353.2</b>					<b>3 Hours</b>			
						<b>22MEE353.3</b>								
						<b>22MEE353.4</b>								
Types of compression mold, open flash, semi-positive type, positive, displacement molds, types of loading chambers, flash thickness, pot design, projected area, compression pressure, clamping force.														
Self-study / Case Study / Applications		Compression Moulding areas of industrial applications.												
Text Book		Text Book 1: 4.1, 4.2, 4.3, 4.4, 4.5												
<b>MODULE-4</b>	<b>PRESS TOOLS</b>					<b>22MEE353.4</b>					<b>3 Hours</b>			

		<b>22MEE353.6</b>		
Types of presses, types of dies, Clearance, die sets, materials of die sets, cutting force, punch design, punch holder and die support, stripper plate, die springs, die wear.				
Self-study / Case Study / Applications	Press tools areas of industrial applications.			
Text Book	Text Book 1: 5.1, 5.2, 5.3, 5.4, 5.5			
<b>MODULE-5</b>	<b>JIGS AND FIXTURES</b>	<b>22MEE353.5</b> <b>22MEE353.6</b>	<b>3 Hours</b>	
Production devices, Elements of jigs and fixtures, Advantages of jigs and fixtures, Inspection devices, Materials used presentation of work piece.				
Self-study / Case Study / Applications	Jigs and fixtures industrial applications and case studies of the same.			
Text Book	Text Book 2: 1.1, 1.2, 1.3, 1.4,1.5, 1.6			
<b>CIE Assessment Pattern (50 Marks - Theory) -</b>				
<b>RBT Levels</b>		<b>Marks Distribution</b>		
		<b>Test (s)</b>	<b>Qualitative Assessment (s)</b>	<b>MCQ's</b>
		<b>25</b>	<b>15</b>	<b>10</b>
<b>L1</b>	<b>Remember</b>	5	-	-
<b>L2</b>	<b>Understand</b>	5	-	-
<b>L3</b>	<b>Apply</b>	5	5	5
<b>L4</b>	<b>Analyze</b>	5	5	5
<b>L5</b>	<b>Evaluate</b>	5	5	-
<b>L6</b>	<b>Create</b>	-	-	-
<b>SEE Assessment Pattern (50 Marks - Theory)</b>				
<b>RBT Levels</b>		<b>Exam Marks Distribution (50)</b>		
<b>L1</b>	<b>Remember</b>	<b>10</b>		
<b>L2</b>	<b>Understand</b>	<b>10</b>		
<b>L3</b>	<b>Apply</b>	<b>10</b>		
<b>L4</b>	<b>Analyze</b>	<b>10</b>		
<b>L5</b>	<b>Evaluate</b>	<b>10</b>		
<b>L6</b>	<b>Create</b>	<b>-</b>		
<b>Suggested Learning Resources:</b>				
<b>Text Books:</b>				
1) Injection Mould Design An Introduction And Design For The Thermoplastics Industry by Pye R G W (Author). Publisher: Affiliated East-West Press Pvt. Ltd.				
2) Jigs and fixtures design manual by P.H.Joshi Publication Tata McGraw Hill Education Private Limited.				
<b>Reference Books:</b>				
1) Press Tools Design and Construction, 2012, by Joshi P.H. (Author), S.Chand and publications.				
2) A Textbook of Production Engineering, 11/e, by P.C.Sharma, S. Chand Publishin.				
3) Tool Engineering and design by G.R. Nagpal., Khanna Publishers.				

**Web links and Video Lectures (e-Resources):**

- <https://www.youtube.com/watch?v=I71YrXafg0o>
- <https://www.youtube.com/watch?v=l-7ivFEAz8>
- [https://www.youtube.com/watch?v=0t\\_kie\\_sBLw](https://www.youtube.com/watch?v=0t_kie_sBLw)
- <https://www.youtube.com/watch?v=uOYIoX3srbw>

**Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning**

- Visit to any manufacturing/aero/auto industry
- Video demonstration of latest trends in Tool Engineering
- Contents related activities (Activity-based discussions)
  - For active participation of students, instruct the students for tool construction
  - Organizing Group wise discussions on tool engineering issues
  - Seminars

<b>INDUSTRIAL WASTE MANAGEMENT</b>														
<b>Course Code</b>	<b>22MEE354</b>								<b>CIE Marks</b>		<b>50</b>			
<b>L:T:P:S</b>	<b>1:0:0:0</b>								<b>SEE Marks</b>		<b>50</b>			
<b>Hrs / Week</b>	<b>01</b>								<b>Total Marks</b>		<b>100</b>			
<b>Credits</b>	<b>01</b>								<b>Exam Hours</b>		<b>03</b>			
<b>Course outcomes:</b>														
At the end of the course, the student will be able to:														
22MEE354.1	Remember the types and characteristics of waste produced.													
22MEE354.2	Evaluate the waste for Recycle, reuse and byproduct recovery.													
22MEE354.3	Investigate the waste with respect to quality and quantity.													
22MEE354.4	Analyze the treatment methods for socially vital issues with critical thought.													
<b>Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:</b>														
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>
22MEE354.1	3	3	3	3	1	-	-	-	-	-	-	2	3	-
22MEE354.2	3	3	3	3	1	-	-	-	-	-	-	2	3	-
22MEE354.3	3	3	3	3	1	-	-	-	-	-	-	2	3	-
22MEE354.4	3	3	3	3	1	-	-	-	-	-	-	2	3	-
<b>MODULE-1 INTRODUCTION 22MEE354.1 3 Hours</b>														
Types of industries and industrial pollution – Characteristics of industrial wastes – Population equivalent – Bioassay studies – effects of industrial effluents on streams, sewer, land, sewage treatment plants and human health – Environmental legislations related to prevention and control of industrial effluents and hazardous wastes.														
Self-study / Case Study / Applications		Investigate the Challenges of Industrial waste on the environment.												
Text Book		Text Book 1: 1.1-1.10												
<b>MODULE-2 CLEANER PRODUCTION 22MEE354.2 3 Hours</b>														
Waste management Approach – Waste Audit – Volume and strength reduction – Material and process modifications – Recycle, reuse and byproduct recovery – Applications.														
Self-study / Case Study / Applications		Investigate the quantity and quality of the industrial waste produced.												
Text Book		Text Book 1: 2.1-2.10												
<b>MODULE-3 POLLUTION FROM MAJOR INDUSTRIES 22MEE354.3 3 Hours</b>														
Sources, Characteristics, waste treatment flow sheets for selected industries such as Textiles, Tanneries, Pharmaceuticals, Electroplating industries, Dairy, Sugar, Paper, distilleries, Steel plants, Refineries, fertilizer, thermal power plants – Wastewater reclamation concepts														
Self-study / Case Study / Applications		Explore the characteristics of the industrial waste.												
Text Book		Text Book 1: 3.1-3.10												
<b>MODULE-4 TREATMENT TECHNOLOGIES 22MEE354.4 3 Hours</b>														

Equalisation – Neutralisation – Removal of suspended and dissolved organic solids - Chemical oxidation – Adsorption - Removal of dissolved inorganics – Combined treatment of industrial and municipal wastes – Residue management – Dewatering – Disposal				
Self-study / Case Study / Applications	Scrutinize the Different types of Optimization techniques.			
Text Book	Text Book 1: 4.1-4.15			
<b>MODULE-5</b>	<b>HAZARDOUS WASTE MANAGEMENT</b>	<b>22MEE354.5</b>	<b>3 Hours</b>	
Hazardous wastes - Physico chemical treatment – solidification – incineration – Secured land fills				
Self-study / Case Study / Applications	Survey on Industrial waste, treatment and case studies of the same.			
Text Book	Text Book 1:5.1-5.15			
<b>CIE Assessment Pattern (50 Marks – Theory) –</b>				
<b>RBT Levels</b>		<b>Marks Distribution</b>		
		<b>Test (s)</b>	<b>Qualitative Assessment (s)</b>	<b>MCQ's</b>
		<b>25</b>	<b>15</b>	<b>10</b>
<b>L1</b>	<b>Remember</b>	4	-	-
<b>L2</b>	<b>Understand</b>	4	-	-
<b>L3</b>	<b>Apply</b>	6	3	5
<b>L4</b>	<b>Analyze</b>	8	7	5
<b>L5</b>	<b>Evaluate</b>	3	5	-
<b>L6</b>	<b>Create</b>	-	-	-
<b>SEE Assessment Pattern (50 Marks – Theory)</b>				
<b>RBT Levels</b>		<b>Exam Marks Distribution (50)</b>		
<b>L1</b>	<b>Remember</b>	<b>10</b>		
<b>L2</b>	<b>Understand</b>	<b>10</b>		
<b>L3</b>	<b>Apply</b>	<b>10</b>		
<b>L4</b>	<b>Analyze</b>	<b>10</b>		
<b>L5</b>	<b>Evaluate</b>	<b>10</b>		
<b>L6</b>	<b>Create</b>	<b>--</b>		
<b>Suggested Learning Resources:</b>				
<b>TEXTBOOKS</b>				
1. M.N.Rao & A.K.Dutta, “Waste water Treatment”, Oxford - IBH Publication, 1995.				
2. W.W. Eckenfelder Jr., “Industrial Water Pollution Control”, McGraw-Hill Book Company, New Delhi, 2000.				
<b>Reference Books:</b>				
1. T.T.Shen, “Industrial Pollution Prevention”, Springer, 1999.				
2. R.L.Stephenson and J.B.Blackburn, Jr., “Industrial Waste water Systems Hand book”, Lewis Publisher, New York, 1998				
3. H.M.Freeman, “Industrial Pollution Prevention Hand Book”, McGraw-Hill Inc., New Delhi, 1995.				
4. Bishop, P.L., “Pollution Prevention: Fundamental & Practice”, McGraw-Hill, 2000.				
<b>Web links and Video Lectures (e-Resources):</b>				
<ul style="list-style-type: none"> <li>• <a href="https://shorturl.at/tLST3">https://shorturl.at/tLST3</a></li> <li>• <a href="https://www.youtube.com/watch?v=aS-U8xsv">https://www.youtube.com/watch?v=aS-U8xsv</a></li> <li>• <a href="https://www.youtube.com/watch?v=HBkwTyBI75M">https://www.youtube.com/watch?v=HBkwTyBI75M</a></li> <li>• <a href="https://archive.nptel.ac.in/courses/105/105/105105160/">https://archive.nptel.ac.in/courses/105/105/105105160/</a></li> </ul>				



- [https://nsf.gov/resources/nsf.gov/2023-03/Bio-inspired%20Design%20Workshop%20Report 2232327 October%202022 Final.508.pdf](https://nsf.gov/resources/nsf.gov/2023-03/Bio-inspired%20Design%20Workshop%20Report%202232327%20October%202022%20Final.508.pdf)

**Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning**

- Visit to manufacturing industry
- Demonstration of waste produce though in the manufacturing or process industry.
- Video demonstration of latest waste treatment methods
- Contents related activities (Activity-based discussions)
  - For active participation of students, instruct the students to prepare Flowcharts and Handouts
  - Organizing Group wise discussions on issues
  - Seminars

<b>BIO INSPIRED DESIGN AND INNOVATION</b>												
<b>Course Code</b>	<b>22BIK36</b>							<b>CIE Marks</b>	<b>50</b>			
<b>L:T:P:S</b>	<b>3:0:0:0</b>							<b>SEE Marks</b>	<b>50</b>			
<b>Hrs / Week</b>	<b>03</b>							<b>Total Marks</b>	<b>100</b>			
<b>Credits</b>	<b>03</b>							<b>Exam Hours</b>	<b>03</b>			
<b>Course outcomes:</b>												
At the end of the course, the student will be able to:												
22BIK36.1	Verify the biomimetics principles in relation to the needs at that moment.											
22BIK36.2	Evaluate the Bio-material properties for health care applications.											
22BIK36.3	Investigate novel bioengineering initiatives by evaluating design and development principles.											
22BIK36.4	Investigate creative biobased solutions for socially vital issues with critical thought.											
22BIK36.5	Understand the bio computing optimization through research and experiential learning.											
22BIK36.6	Explain the fundamental biological ideas through pertinent industrial applications and case studies.											
<b>Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:</b>												
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>
22BIK36.1	3	3	3	3	2	-	2	-	1	-	-	2
22BIK36.2	3	3	3	3	2	-	2	-	1	-	-	2
22BIK36.3	3	3	3	3	2	-	2	-	1	-	-	2
22BIK36.4	3	3	3	3	2	-	2	-	1	-	-	2
22BIK36.5	3	3	3	3	2	-	2	-	1	-	-	2
22BIK36.6	3	3	3	3	2	-	2	-	1	-	-	2
<b>MODULE-1 BIO-INSPIRED DESIGN AND ENGINEERING 22BIK36.1 8 Hours</b>												
Bio-Inspired Engineering and design, History, Evolution, Basics of Biomimetics and other Disciplines, Rawling's Classifications, Need for Bio-Inspired Designs. Bio inspired Additive manufacturing techniques, (self-healing, self-assembly).												
Self-study / Case Study / Applications		Investigate the Challenges of Bio inspired design, Compare with traditional areas of science and engineering.										
Text Book		Text Book 1: 1.2, 1.3, 1.4, 1.13, 1.15, 1.16										
<b>MODULE-2 BIO MATERIALS AND BIO HEALTHCARE DESIGN 22BIK36.2 8 Hours</b>												
Biomaterials, Design of Forms- (Hexagonal unit cells, Intrinsic disorder, anisotropy), Design of materials- (Hierarchy, fracture tough materials, structural colours, Actuating Materials, Bio-Compatible Materials). Bio-Mechanics, Applications of Biomaterials and Bio systems in Health care design (Human Prosthetics, Parasitic Wasp-Inspired Needle, Octopus-Inspired Sucker for Tissue Grafting, Peacock-Inspired Biosensors, Gecko-Inspired Surgical Glue) Robotics, Marine and Aeronautical.												
Self-study / Case Study / Applications		Investigate Bio-Compatible alloys and polymers for human implants and health care applications.										
Text Book		Text Book 1: 2.2, 2.3, 2.4 to 2.15										
<b>MODULE-3 BIO SUSTAINABLE DEVELOPMENT 22BIK36.3, 22BIK36.4 8 Hours</b>												
Innovations in Energy (Termite mound inspired shopping malls), Innovations in Resource-Air (purification, filtration), Dew water collection systems, water purification, desalination, Management of spaces, designs for megastructures.												

Self-study / Case Study / Applications	Explore the Bio inspired environmental constructions and development.			
Text Book	Text Book 2: 3.1, 3.3, 3.5, 3.7, 3.10			
<b>MODULE-4</b>	<b>BIO COMPUTING AND OPTIMISATION</b>	<b>22BIK36.5</b>	<b>8 Hours</b>	
No Free Lunch Theorem, Bat Algorithm, Flower Pollination Algorithm, Genetic Algorithm- Crossover and Mutation Operations. Bio-Inspired Optimisation, Ant Colony Optimisation (ACO), Swarm Intelligence- Particle Swarm Optimisation (PSO).				
Self-study / Case Study / Applications	Study the Different types of Optimization techniques, genetic research.			
Text Book	Text Book 1: 6.1, 6.3, 6.5, 6.7, Text Book 2: 10.1, 10.3, 10.5, 10.7			
<b>MODULE-5</b>	<b>APPLICATIONS OF BIO-INSPIRED INNOVATIONS</b>	<b>22BIK36.6</b>	<b>8 Hours</b>	
Bioinspired innovations in- Automotive, Automation, Materials and Manufacturing, Sensors, Controllers, Communications, Healthcare, Agriculture, food production, and Sports, Environment infrastructure. Carbon Neutral Solutions (Coral Reefs, Eco-cements), Carbon Free Solutions (Lotus leaf inspired paints), eco-restorations (Eco-friendly pesticide).				
Self-study / Case Study / Applications	Survey on Bio inspired Innovations, design, applications and case studies of the same.			
Text Book	Text Book 2: 12.1 to 12.10			
<b>CIE Assessment Pattern (50 Marks - Theory) -</b>				
<b>RBT Levels</b>		<b>Marks Distribution</b>		
		<b>Test (s)</b>	<b>Qualitative Assessment (s)</b>	<b>MCQ's</b>
		<b>25</b>	<b>15</b>	<b>10</b>
<b>L1</b>	<b>Remember</b>	-	-	-
<b>L2</b>	<b>Understand</b>	5	-	-
<b>L3</b>	<b>Apply</b>	10	5	5
<b>L4</b>	<b>Analyze</b>	5	5	5
<b>L5</b>	<b>Evaluate</b>	5	5	-
<b>L6</b>	<b>Create</b>	-	-	-
<b>SEE Assessment Pattern (50 Marks - Theory)</b>				
<b>RBT Levels</b>		<b>Exam Marks Distribution (50)</b>		
<b>L1</b>	<b>Remember</b>	<b>10</b>		
<b>L2</b>	<b>Understand</b>	<b>10</b>		
<b>L3</b>	<b>Apply</b>	<b>10</b>		
<b>L4</b>	<b>Analyze</b>	<b>10</b>		
<b>L5</b>	<b>Evaluate</b>	<b>10</b>		
<b>L6</b>	<b>Create</b>	<b>--</b>		
<b>Suggested Learning Resources:</b>				
<b>Text Books:</b>				
1) Helena Hashemi Farzaneh, Udo Lindemann, A Practical Guide to Bio-inspired Design, Springer Vieweg, 1st edition 2019, ISBN-10 : 366257683X, ISBN-13 : 978-3662576830				
2) Torben A. Lenau, Akhlesh Lakhtakia, Biologically Inspired Design: A Primer (Synthesis Lectures on Engineering, Science, and Technology, Publisher: Morgan & Claypool Publishers, 2021, ISBN-10: 1636390471, ISBN-13: 978-1636390475				

**Reference Books:**

- 1) French M, Invention and evolution: Design in Nature and Engineering, Publisher: Cambridge University Press, 2020
- 2) Pan L., Pang S., Song T. and Gong F. eds, Bio-Inspired Computing: Theories and Applications, 15th International Conference, BIC-TA 2020, Qingdao, China, October 23-25, 2020, Revised Selected Papers (Vol. 1363). Springer Nature, 2021
- 3) Wann D, Bio Logic: Designing with nature to Protect the Environment, Wiley Publisher, 1994

**Web links and Video Lectures (e-Resources):**

- [https://onlinecourses.nptel.ac.in/noc22\\_ge24/preview](https://onlinecourses.nptel.ac.in/noc22_ge24/preview)
- <https://biodesign.berkeley.edu/bioinspired-design-course/>
- <https://www.youtube.com/watch?v=cwxXY9Qe8ss>
- <https://www.youtube.com/watch?v=V2GvQXvjhLA>
- <https://nsf-gov-resources.nsf.gov/2023-03/Bio-inspired%20Design%20Workshop%20Report%202232327%20October%202022%20Final.508.pdf>

**Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning**

- Presenting students with bio-inspired design challenges and asking them to come up with solutions.
- Create physical models or prototypes that mimic biological structures or functions.
- Organizing Group wise discussions on issues
- Seminars

### NATIONAL SERVICE SCHEME (NSS)

<b>Course Code</b>	<b>22NSS30</b>	<b>CIE Marks (each Semester)</b>	<b>50</b>
<b>L:T:P:S</b>	<b>0:0:0:0</b>	<b>SEE Marks</b>	<b>--</b>
<b>Hrs / Week</b>	<b>02</b>	<b>Total Marks</b>	<b>50 x 4 = 200</b>
<b>Credits</b>	<b>00</b>	<b>Exam Hours</b>	<b>02</b>

**Course outcomes:**

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

22NSS30.1	Understand the importance of his / her responsibilities towards society.
22NSS30.2	Analyse the environmental and societal problems/issues and will be able to design solutions for the same.
22NSS30.3	Evaluate the existing system and to propose practical solutions for the same for sustainable development. Implement government or self-driven projects effectively in the field.
22NSS30.4	Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.

**Mapping of Course Outcomes to Program Outcomes:**

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
22NSS30.1	-	-	-	-	-	3	-	-	2	-	-	1
22NSS30.2	-	-	-	-	-	3	3	-	2	-	-	1
22NSS30.3	-	-	-	-	-	3	3	-	2	-	-	1
22NSS30.4	-	-	-	-	-	3	3	-	2	-	-	1

<b>Semester/ Course Code</b>	<b>CONTENT</b>	<b>COs</b>	<b>HOURS</b>
<b>22NSS30</b>	<ol style="list-style-type: none"> <li>Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing</li> <li>Waste management–Public, Private and Govt organization, 5R's.</li> <li>Setting of the information imparting club for women leading to contribution in social and economic issues.</li> </ol>	22NSS30.1, 22NSS30.2, 22NSS30.3, 22NSS30.4	30 HRS

**CIE Assessment Pattern (50 Marks – Activity based) –**

<b>CIE component for every semester</b>	<b>Marks</b>
Presentation - 1 Selection of topic, PHASE - 1	10
Commencement of activity and its progress - PHASE - 2	10
Case study-based Assessment Individual performance	10
Sector wise study and its consolidation	10
Video based seminar for 10 minutes by each student at the end of semester with Report.	10
<b>Total marks for the course in each semester</b>	<b>50</b>

- Implementation strategies of the project (NSS work).
- The last report should be signed by NSS Officer, the HOD and principal.
- At last report should be evaluated by the NSS officer of the institute.
- Finally, the consolidated marks sheet should be sent to the university and also to be made available at LIC visit.

**Suggested Learning Resources:****Reference Books:**

1. NSS Course Manual, Published by NSS Cell, VTU Belagavi.
2. Government of Karnataka, NSS cell, activities reports and its manual.
3. Government of India, NSS cell, Activities reports and its manual.

**Pre-requisites to take this Course:**

1. Students should have a service-oriented mindset and social concern.
2. Students should have dedication to work at any remote place, anytime with available resources and proper time management for the other works.
3. Students should be ready to sacrifice some of the time and wishes to achieve service-oriented targets on time.

**Pedagogy:**

- In every semester from 3rd semester to 6th semester, each student should do activities according to the scheme and syllabus.
- At the end of every semester student performance has to be evaluated by the NSS officer for the assigned activity progress and its completion.
- At last, in 6th semester consolidated report of all activities from 3rd to 6th semester, compiled report should be submitted as per the instructions.
- State the need for NSS activities and its present relevance in the society and provide real-life examples.
- Support and guide the students for self-planned activities.
- NSS coordinator will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress in real activities in the field.
- Encourage the students for group work to improve their creative and analytical skills.

**Plan of Action:**

- Student/s in individual or in a group Should select any one activity in the beginning of each semester till end of that respective semester for successful completion as per the instructions of NSS officer with the consent of HOD of the department.
- At the end of every semester, activity report should be submitted for evaluation.
- Practice Session Description:
  - Lecture session by NSS Officer
  - Students Presentation on Topics
  - Presentation - 1, Selection of topic, PHASE – 1
  - Commencement of activity and its progress - PHASE – 2
  - Execution of Activity
  - Case study-based Assessment, Individual performance
  - Sector/ Team wise study and its consolidation
  - Video based seminar for 10 minutes by each student at the end of semester with Report.

Sl No	Topic	Groupsize	Location	Activity execution	Reporting	Evaluation of the Topic
1.	Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.	May be individual or team	Farmers land/Villages/ roadside / Community area / College campus	Site selection /proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
2.	Waste management- Public, Private and Govt organization, 5 R's.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers/ campus	Site selection /proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
3.	Setting of the information imparting club for women leading to contribution in social and economic issues.	May be individual or team	Women empowerment groups/ Consulting NGOs & Govt Teams / College campus	Group selection/ proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
4.	Water conservation techniques – Role of different stakeholders– Implementation.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers/ campus	site selection / proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer

5.	Preparing an actionable business proposal for enhancing the village income and approach for implementation.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers/ campus	Group selection/ proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
6.	Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.	May be individual or team	Local government / private/ aided schools/ Government Schemes officers	School selection/ proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
7.	Developing Sustainable Water management system for rural areas and implementation approaches.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers/ campus	site selection/ proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
8.	Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers/ campus	Group selection/ proper consultation/ Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer



9.	Spreading public awareness under rural outreach programs. (minimum 5 programs)	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers/ campus	Group selection/ proper consultation/ Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
10.	Organize National integration and social harmony events / workshops / seminars. (Minimum 02 programs).	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers/ campus	Place selection/ proper consultation/ Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
11.	Govt. school Rejuvenation and helping them to achieve good infrastructure.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers/ campus	Place selection/ proper consultation/ Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer

<b>PHYSICAL EDUCATION (PE) (SPORTS AND ATHLETICS)</b>												
<b>Course Code</b>	<b>22PED30</b>						<b>CIE Marks (each semester)</b>			<b>50</b>		
<b>L:T:P:S</b>	<b>0:0:0:0</b>						<b>SEE Marks</b>			<b>--</b>		
<b>Hrs / Week</b>	<b>02</b>						<b>Total Marks</b>			<b>50 x 2= 100</b>		
<b>Credits</b>	<b>00</b>						<b>Exam Hours</b>			<b>02</b>		
<b>Course outcomes:</b>												
At the end of the course, the student will be able to:												
22PED30.1	Understand the fundamental concepts and skills of Physical Education, Health, Nutrition and Fitness											
22PED30.2	Create consciousness among the students on Health, Fitness and Wellness in developing and maintaining a healthy lifestyle											
22PED30.3	Perform in the selected sports or athletics of student's choice and participate in the competition at regional/state / national / international levels.											
22PED30.4	Understand the roles and responsibilities of organization and administration of sports and games											
<b>Mapping of Course Outcomes to Program Outcomes:</b>												
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>
22PED30.1	-	-	-	-	-	2	-	3	3	-	-	2
22PED30.2	-	-	-	-	-	2	-	3	3	-	-	2
22PED30.3	-	-	-	-	-	2	-	3	3	-	-	2
22PED30.4	-	-	-	-	-	2	-	3	3	-	-	2
<b>Semester</b>	<b>CONTENT</b>								<b>COs</b>		<b>HOURS</b>	
<b>22PED30</b>	<b>Module 1: Orientation</b> A. Lifestyle, B. Fitness C. Food & Nutrition D. Health & Wellness E. Pre-Fitness test.								22PED30.1, 22PED30.2		5 HRS	
	<b>Module 2: General Fitness &amp; Components of Fitness</b> A. Warming up (Free Hand exercises) B. Strength – Push-up / Pull-ups C. Speed – 30 Mtr Dash D. Agility – Shuttle Run E. Flexibility – Sit and Reach F. Cardiovascular Endurance – Harvard step Test								22PED30.2, 22PED30.3		15 HRS	
	<b>Module 3: Recreational Activities</b> A. Postural deformities. B. Stress management. C. Aerobics. D. Traditional Games.								22PED30.3, 22PED30.4		10 HRS	
<b>CIE Assessment Pattern (50 Marks – Practical) –</b>												
CIE to be evaluated every semester end based on practical demonstration of Sports and Athletics activities learnt in the semester.												
<b>CIE</b>						<b>Marks</b>						
Participation of student in all the modules						10						
Quizzes – 2, each of 7.5 marks						15						

	Final presentation / exhibition / Participation in competitions/ practical on specific tasks assigned to the students	25	
	<b>Total</b>	<b>50</b>	

**Suggested Learning Resources:**

**Reference Books:**

1. Saha, A.K. Sarir Siksher Ritiniti, Rana Publishing House, Kalyani.
2. Bandopadhyay, K. Sarir Siksha Parichay, Classic Publishers, Kolkata.
3. Petipus, et.al., Athlete's Guide to Career Planning, Human Kinetics.
4. Dharma, P.N. Fundamentals of Track and Field, Khel Sahitya Kendra, New Delhi.
5. Jain, R. Play and Learn Cricket, Khel Sahitya Kendra, New Delhi.
6. Vivek Thani, Coaching Cricket, Khel Sahitya Kendra, New Delhi.
7. Saha, A.K. Sarir Siksher Ritiniti, Rana Publishing House, Kalyani.
8. Bandopadhyay, K. Sarir Siksha Parichay, Classic Publishers, Kolkata
9. Naveen Jain, Play and Learn Basketball, Khel Sahitya Kendra, New Delhi.
10. Dubey H.C., Basketball, Discovery Publishing House, New Delhi.
11. Rachana Jain, Teach Yourself Basketball, Sports Publication.
12. Jack Nagle, Power Pattern Offences for Winning basketball, Parker Publishing Co., New York.
13. Renu Jain, Play and Learn Basketball, Khel Sahitya Kendra, New Delhi.
14. SallyKus, Coaching Volleyball Successfully, Human Kinetics.

YOGA												
Course Code	22YOG30						CIE Marks (each Semester)	50				
L:T:P:S	0:0:0:0						SEE Marks	--				
Hrs / Week	2						Total Marks	50 x 4 = 200				
Credits	00						Exam Hours	02				
<b>Course outcomes:</b>												
At the end of the course, the student will be able to:												
22YOG30.1	Use Yogasana practices in an effective manner											
22YOG30.2	Become familiar with an authentic foundation of Yogic practices											
22YOG30.3	Practice different Yogic methods such as Suryanamaskara, Pranayama and some of the Shat Kriyas											
22YOG30.4	Use the teachings of Patanjali in daily life.											
<b>Mapping of Course Outcomes to Program Outcomes:</b>												
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
22YOG30.1	-	-	-	-	-	3	-	-	-	-	-	1
22YOG30.2	-	-	-	-	-	3	-	-	-	-	-	1
22YOG30.3	-	-	-	-	-	3	-	-	-	-	-	1
22YOG30.4	-	-	-	-	-	3	-	-	-	-	-	1
<b>Semester / Course Code</b>	<b>CONTENT</b>								<b>COs</b>	<b>HOURS</b>		
<b>3<sup>rd</sup> 22YOG30</b>	<p><b>Introduction of Yoga:</b> Aim and Objectives of yoga, Prayer: Yoga, its origin, history and development. Yoga, its meaning, definitions. Different schools of yoga, importance of prayer</p> <p><b>Brief introduction of yogic practices for common man:</b> Yogic practices for common man to promote positive health</p> <p><b>Rules and regulations:</b> Rules to be followed during yogic practices by practitioner</p> <p><b>Misconceptions of yoga:</b> Yoga its misconceptions, Difference between yogic and non-yogic practices.</p> <p><b>Suryanamaskara:</b></p> <ol style="list-style-type: none"> <li>1. Suryanamaskar prayer and its meaning, Need, importance a benefits of Suryanamaskar.</li> <li>2. Suryanamaskar 12 count, 2 rounds</li> </ol> <p><b>Different types of Asanas:</b></p> <ol style="list-style-type: none"> <li>1. Sitting: Padmasana, Vajrasana, Sukhasana</li> <li>2. Standing: Vrikshana, Trikonasana, Ardhakati Chakrasana</li> <li>3. Prone line: Bhujangasana, Shalabhasana</li> <li>4. Supine line: Utthitadvipadasana, Ardhalasana, Halasana</li> </ol>								22YOG30.1, 22YOG30.2, 22YOG30.3, 22YOG30.4	Total 32 Hrs/ Semester  2 Hrs/week		
<b>CIE Assessment Pattern (50 Marks - Practical) -</b>												
CIE to be evaluated every semester based on practical demonstration of Yogasana learnt in the semester and internal tests (objective type)												
						<b>CIE</b>	<b>Marks</b>					
						Avg of Test 1 and Test 2	25					
						Demonstration of Yogasana	25					
						<b>Total</b>	<b>50</b>					

**Suggested Learning Resources:****Reference Books:**

4. Swami Kuvulyananda: Asma (Kavalyadhama, Lonavala)
5. Tiwari, O P: Asana Why and How
6. Ajitkumar: Yoga Pravesha (Kannada)
7. Swami Satyananda Saraswati: Asana Pranayama, Mudra, Bandha (Bihar School of yoga, Munger)
8. Swami Satyananda Saraswati: Surya Namaskar (Bihar School of yoga, Munger)
9. Nagendra H R: The art and science of Pranayama
10. Tiruka: Shatkriyegalu (Kannada)
11. Iyengar B K S: Yoga Pradipika (Kannada)
12. Iyengar B K S: Light on Yoga (English)

**Web links and Video Lectures (e-Resources):**

- <https://youtu.be/KB-TYlgd1wE>
- <https://youtu.be/aa-TG0Wg1Ls>

<b>SOCIAL CONNECT AND RESPONSIBILITY</b>												
<b>Course Code</b>	22SCK37							<b>CIE Marks</b>	50			
<b>L:T:P:S</b>	0:0:1:0							<b>SEE Marks</b>	--			
<b>Hrs / Week</b>	02							<b>Total Marks</b>	50			
<b>Credits</b>	01							<b>Exam Hours</b>	02			
<b>Course outcomes:</b>												
At the end of the course, the student will be able to:												
22SCK37.1	Communicate and connect to the surrounding											
22SCK37.2	Understand the needs and problems of the community and involve them in problem -solving											
22SCK37.3	Develop among themselves a sense of social & civic responsibility and utilize their knowledge in finding practical solutions to individual and community problems											
22SCK37.4	Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes											
<b>Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:</b>												
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>
22SCK37.1	-	-	-	-	-	3	2	-	2	3	-	1
22SCK37.2	-	-	-	-	-	3	2	-	2	3	-	1
22SCK37.3	-	-	-	-	-	3	2	-	2	3	-	1
22SCK37.4	-	-	-	-	-	3	2	-	2	3	-	1
<b>MODULE-1</b>	<b>PLANTATION AND ADOPTION OF A TREE</b>							<b>22SCK37.1, 22SCK37.2</b>		<b>3 Hours</b>		
Plantation of a tree that will be adopted for three years by a group of B. Tech students. (ONE STUDENT ONE TREE) They will also make an excerpt either as a documentary or a photo blog describing the plant's origin, its usage in daily life, its appearance in folklore and literature -- Objectives, Visit, case study, report, outcomes.												
<b>MODULE-2</b>	<b>HERITAGE WALK AND CRAFTS CORNER</b>							<b>22SCK37.2, 22SCK37.3</b>		<b>3 Hours</b>		
Heritage tour, knowing the history and culture of the city, connecting to people around through their history, knowing the city and its craftsman, photo blog and documentary on evolution and practice of various craft forms- Objectives, Visit, case study, report, outcomes.												
<b>MODULE-3</b>	<b>ORGANIC FARMING AND WASTE MANAGEMENT</b>							<b>22SCK37.3, 22SCK37.4</b>		<b>3 Hours</b>		
Usefulness of organic farming, wet waste management in neighboring villages, and implementation in the campus – Objectives, Visit, case study, report, outcomes.												
<b>MODULE-4</b>	<b>WATER CONSERVATION</b>							<b>22SCK37.3, 22SCK37.4</b>		<b>3 Hours</b>		
Knowing the present practices in the surrounding villages and implementation in the campus, documentary or photoblog presenting the current practices – Objectives, Visit, case study, report, outcomes.												
<b>MODULE-5</b>	<b>FOOD WALK</b>							<b>22SCK37.1, 22SCK37.4</b>		<b>3 Hours</b>		
City's culinary practices, food lore, and indigenous materials of the region used in cooking – Objectives, Visit, case study, report, outcomes.												

**CIE Assessment Pattern (50 Marks - Activity based) -**

- **Each module is evaluated as given below and 100 marks in scaled down to 50 as final marks.**

<b>CIE component for each module</b>	<b>Marks</b>
Field Visit, Plan, Discussion	10
Commencement of activities and its progress	20
Case study-based Assessment Individual performance with report	20
Module wise study & its consolidation 5*5 = 25	25
Video based seminar for 10 minutes by each student at the end of semester with Report. Activities 1 to 5, 5*5 = 25	25
<b>Total</b>	<b>100</b>

- Implementation strategies of the project (NSS work).
- Individual student has to submit a final report which should be signed by NSS Officer, the HOD and Principal.
- Finally, the consolidated marks sheet and the reports should be available in the department. .

**Activity-Based Learning / Practical Based learning**

- Platform to connect to others and share the stories with others:
  - Jamming session
  - Open mic
  - Poetry
- Share the experience of Social Connect.
- Exhibit the talent like playing instruments, singing, one-act play, art-painting, and fine art.

**Pedagogy:**

- The students will be divided into groups. Each group will be handled by faculty mentor.
- A total of 40 - 50 hrs engagement in the semester
- Faculty mentor will design the activities (particularly Jamming sessions, open mic and poetry)
- The course is mainly activity-based that will offer a set of activities for the student that enables them to connect with fellow human beings, nature, society, and the world at large.
- The course will engage students for interactive sessions, open mic, reading group, storytelling sessions, and semester-long activities conducted by faculty mentors.
- Students should present the progress of the activities as per the schedule in the prescribed practical session in the field.
- There should be positive progress in the vertical order for the benefit of society in general through activities.

**Plan of Action:**

- Each student should do activities according to the scheme and syllabus.
- At the end of semester student performance has to be evaluated by the faculty mentor for the assigned activity progress and its completion.
- At last consolidated report of all activities from 1<sup>st</sup> to 5<sup>th</sup>, compiled report should be submitted as per the instructions and scheme.
- Practice Session Description:
  - Lecture session in field to start activities
  - Students Presentation on Ideas
  - Commencement of activity and its progress
  - Execution of Activity
  - Case study-based Assessment, Individual performance
  - Sector/ Team wise study and its consolidation
  - Video based seminar for 10 minutes by each student at the end of semester with Report.

Sl No	Topic	Groupsize	Location	Activity execution	Reporting	Evaluation of the Topic
1.	<b>Plantation and adoption of a tree</b>	May be individual or team (3-5)	Farmers land/ parks / Villages / roadside/ community area / College campus	Site selection / Proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus
2.	<b>Heritage walk and crafts corner</b>	May be individual or team (3-5)	Temples / monumental places / Villages/ City Areas / Grama panchayat/ public associations /Government	Site selection /Proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus



			Schemes officers/ campus			
3.	<b>Organic farming and waste management</b>	May be individual or team (3-5)	Farmers land / parks /Villages visits / roadside/ communityarea / College campus	Group selection / proper consultation / Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus
4.	<b>Water conservation : Conservation techniques</b>	May be individual or team (3-5)	Villages/ City Areas /Grama panchayat/ public associations/ Government Schemes officers / campus	site selection / proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus
5.	<b>Food walk: Practices in society</b>	May be individual or team (3-5)	Villages/ City Areas /Grama panchayat/ public associations/ Government Schemes officers/ campus	Group selection / proper consultation / Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus

<b>BASIC APPLIED MATHEMATICS-I</b>												
<b>Course Code</b>	22DMAT31					<b>CIE Marks</b>					<b>50</b>	
<b>L:T:P:S</b>	0:0:0:0					<b>SEE Marks</b>					--	
<b>Hrs. / Week</b>	02					<b>Total Marks</b>					<b>50</b>	
<b>Credits</b>	00					<b>Exam Hours</b>					--	
<b>Course outcomes:</b>												
At the end of the course, the student will be able to:												
22DMAT31.1	Know the principles of engineering mathematics through calculus											
22DMAT31.2	Determine the power series expansion of a function											
22DMAT31.3	Find the definite integrals with standard limits and also develop the ability to solve different types of differential equations											
22DMAT31.4	Apply ideas from linear algebra in solving systems of linear equations and determine the Eigen values and Eigen vectors of a matrix											
<b>Mapping of Course Outcomes to Program Outcomes:</b>												
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>
22DMAT31.1	3	3	-	-	-	-	-	-	-	-	-	-
22DMAT31.2	3	3	-	-	-	-	-	-	-	-	-	-
22DMAT31.3	3	3	-	-	-	-	-	-	-	-	-	-
22DMAT31.4	3	3	-	-	-	-	-	-	-	-	-	-
<b>MODULE-1</b>	<b>DIFFERENTIAL CALCULUS</b>										<b>22DMAT31.1</b> <b>22DMAT31.2</b>	<b>8 Hours</b>
Polar Curves-Problems on angle between the radius vector and tangent, Angle between two curves-Problems, Pedal equation for polar curves-Problems. Maclaurin's theorem for function of one variable (statement only)-Problems.												
Text Book	Text Book 1: 4.4, 4.7, 4.8, Text Book 2: 15.4											
<b>MODULE-2</b>	<b>PARTIAL DIFFERENTIATION</b>										<b>22DMAT31.1</b>	<b>8 Hours</b>
Definition and Simple problems, Euler's theorem for Homogeneous function (NO Derivation and NO extended theorem Problems, Jacobians of order two - definition and problems.												
Text Book	Text Book 1: 5.4, 5.7,											
<b>MODULE-3</b>	<b>INTEGRAL CALCULUS AND DIFFERENTIAL EQUATIONS</b>										<b>22DMAT31.3</b>	<b>8 Hours</b>
Problems on evaluation of $\sin n x$ and $\cos n x$ integrals with standard limits ( $0$ to $\pi/2$ ). Solution of first order and first-degree differential equations-Variable separable, Linear and Exact differential equations.												
Text Book	Text Book 1: 6.2, 11.6, 11.9, 11.11, Text Book 2: 1.3, 1.4, 1.5											
<b>MODULE-4</b>	<b>LINEAR ALGEBRA-1</b>										<b>22DMAT31.4</b>	<b>8 Hours</b>
Problems on rank of a matrix by elementary transformations, Solution of system of linear equations by Gauss elimination method-Problems.												
Text Book	Text Book 1: 2.7, 28.6, Text Book 2: 7.3, 7.4											
<b>MODULE-5</b>	<b>LINEAR ALGEBRA-2</b>										<b>22DMAT31.4</b>	<b>8 Hours</b>
Linear transformation, Eigen values and Eigen Vectors of square matrix-Problems.												
Text Book	Text Book 1: 2.11, 2.13, Text Book 2: 7.9, 8.1.											
<b>CIE Assessment Pattern (50 X 2=100 Marks - Theory)</b>												
<b>RBT Levels</b>		<b>Marks Distribution</b>										
		<b>Test (s)</b>	<b>Qualitative Assessment (s)</b>	<b>MCQ's</b>								
		<b>25</b>	<b>15</b>	<b>10</b>								
<b>L1</b>	<b>Remember</b>	5	5	-								
<b>L2</b>	<b>Understand</b>	5	5	-								
<b>L3</b>	<b>Apply</b>	10	5	10								
<b>L4</b>	<b>Analyze</b>	2.5	-	-								

L5	Evaluate	2.5	-	-	
L6	Create	-	-	-	

**Suggested Learning Resources:**

**Text Books:**

- 1) B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, Forty fourth Edition, 2022, ISBN: 9788193328491.
- 2) Erwin Kreyszig, Advanced Engineering Mathematics, Wiley-India Publishers, Tenth Edition, Reprint 2016, ISBN: 9788126554232.

**Reference Books:**

- 1) Glyn James, Advanced Modern Engineering Mathematics, Pearson Education, Fourth Edition, 2015, ISBN: 9780273719236.
- 2) B. V. Ramana, Higher Engineering Mathematics, McGraw Hill Education (India) Private Limited, Fourth Edition, 2017, ISBN: 9780070634190.
- 3) H. K. Dass, Advanced Engineering Mathematics, S. Chand & Company Ltd., Twenty Second Edition, 2018, ISBN: 9789352533831.
- 4) N.P.Bali and Manish Goyal, A Text Book of Engineering Mathematics, Laxmi Publications (P) Ltd., Ninth Edition, 2014, ISBN: 9788131808320.

**Web links and Video Lectures (e-Resources):**

- 1) [https://youtu.be/IUV0\\_Nj4d1s?si=eO3s7keCbCO1\\_jcz](https://youtu.be/IUV0_Nj4d1s?si=eO3s7keCbCO1_jcz)
- 2) <https://youtu.be/VzUcs7aiqgg?si=YLtTUGr4Xp88KGY3>
- 3) <https://youtu.be/LDBnS4c7YbA?si=udUOdJ-u0ZxFmBAW>
- 4) [https://youtu.be/palSdK9P-ns?si=7A8\\_VSxEI4lGvksB](https://youtu.be/palSdK9P-ns?si=7A8_VSxEI4lGvksB)
- 5) <https://youtu.be/Bw5yEqwMjQU?si=jzbnkZmVev1w8K2S>
- 6) [https://youtu.be/LBqdGn1r\\_fQ?si=DWcAliFnosT7zikY](https://youtu.be/LBqdGn1r_fQ?si=DWcAliFnosT7zikY)
- 7) <https://youtu.be/N5YCGOyTSuU?si=Wsf75V5fkUpfVVxr>
- 8) <https://youtu.be/gd1FYn86P0c?si=7drzBEqVFSv6sQeZ>
- 9) <https://youtu.be/cSj82GG6MX4?si=4QN1DFXEqaJoUBn7>
- 10) <https://youtu.be/0c3yq9btr3A?si=jloz8eu5TgV7mh8G>
- 11) <https://youtu.be/PhfbEr2btGQ?si=HVK1uk65oHph0t8G>

**Activity-Based Learning (Suggested Activities in Class)/Practical Based Learning:**

- Contents related activities (Activity-based discussions)
  - For active participation of students, instruct the students to prepare Algorithms/Flowcharts/Programming Codes
  - Organizing Group wise discussions on related topics
  - Seminars

## **IV Semester Syllabus**

<b>NUMERICAL, COMPLEX ANALYSIS AND PROBABILITY THEORY</b>												
<b>Course Code</b>	<b>22MAE41</b>						<b>CIE Marks</b>				<b>50</b>	
<b>L:T:P:S</b>	<b>3:0:0:0</b>						<b>SEE Marks</b>				<b>50</b>	
<b>Hrs. / Week</b>	<b>3</b>						<b>Total Marks</b>				<b>100</b>	
<b>Credits</b>	<b>03</b>						<b>Exam Hours</b>				<b>03</b>	
<b>Course outcomes:</b>												
At the end of the course, the student will be able to:												
22MAE41.1	Solve initial value problems using appropriate numerical methods											
22MAE41.2	Apply the concepts of Complex variables to solve Engineering Problems											
22MAE41.3	Apply the concepts of Transformations, Complex integration, Poles and Residuals in the stability analysis of engineering problems											
22MAE41.4	Gain ability to use probability distributions to analyze and solve real time problems											
22MAE41.5	Apply the concept of sampling distribution to solve engineering problems											
22MAE41.6	Use the concepts to analyze the data to make decision about the hypothesis											
<b>Mapping of Course Outcomes to Program Outcomes:</b>												
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>
22MAE41.1	3	3	-	-	-	-	-	-	-	-	-	-
22MAE41.2	3	3	-	-	-	-	-	-	-	-	-	-
22MAE41.3	3	3	-	-	-	-	-	-	-	-	-	-
22MAE41.4	3	3	-	-	-	-	-	-	-	-	-	-
22MAE41.5	3	3	-	-	-	-	-	-	-	-	-	-
22MAE41.6	3	3	-	-	-	-	-	-	-	-	-	-
<b>MODULE-1 NUMERICAL METHODS 22MAE41.1 8 Hours</b>												
Numerical solution of ordinary differential equations of first order and of first degree: Taylor's series method, Modified Euler's method and Runge-Kutta method of fourth-order-Problems. Milne's predictor and corrector methods-Problems. Numerical Solution of second order ordinary differential equations by Runge-Kutta method of fourth-order-Problems.												
Case Study	Case studies on Numerical Analysis.											
Text Book	Text Book 1: 32.3, 32.5, 32.7, 32.9, 32.12, Text Book 2: 21.1.											
<b>MODULE-2 COMPLEX VARIABLES 22MAE41.2 8 Hours</b>												
Functions of complex variables, Analytical functions, Cauchy-Riemann Equations in Cartesian and Polar forms, Harmonic functions and Construction of analytic functions-Problems using Milne-Thompson's method.												
Application	Applications of Flow Problems-Velocity potential, Stream functions and complex potential functions.											
Text Book	Text Book 1: 20.2, 20.4, 20.5, 20.6, Text Book 2: 13.1, 13.2, 13.3, 13.4.											
<b>MODULE-3 CONFORMAL TRANSFORMATIONS AND COMPLEX INTEGRATIONS 22MAE41.3 8 Hours</b>												
$W = z^2$ and $W = e^z$ . Cauchy's Theorem (with proof), Generalized Cauchy's integral formula, Singularities, Poles and Residues, Residue theorem (without proof)-Problems.												
Text Book	Text Book 1: 20.10, 20.13, 20.14, 20.18. Text Book 2: 14.1, 14.2, 14.3, 14.4, 16.1, 16.2, 16.3, 16.4, 17.1.											
<b>MODULE-4 PROBABILITY DISTRIBUTIONS 22MAE41.4 8 Hours</b>												
Random variables (discrete and continuous), probability density functions, Discrete Probability distributions: Binomial and Poisson Distributions-Problems. Continuous Probability distributions: Exponential and Normal Distributions-Problems. Joint Probability Distribution-Problems.												
Case Study	Case studies of Probability Theory in signal & image processing and in Optical communication system.											
Text Book	Text Book 1: 26.8, 26.9, 26.12, 26.14, 26.15, 26.16.											

<b>MODULE-5</b>	<b>SAMPLING THEORY</b>	<b>22MAE41.5</b> <b>22MAE41.6</b>	<b>8 Hours</b>	
Sampling, Sampling distributions, test of hypothesis of large samples for means and proportions, Inferences for variance and proportion. Central limit theorem (without proof), Confidence limits for means, Student's t-distribution, Chi-Square test of goodness of fit and F-distribution for test of goodness of fit for small samples.				
Case Study	Case Studies of Sampling Theory in multi band signal Analysis and Extension of Sampling Theorem in speech Compression.			
Text Book	Text Book 1: 27.2, 27.3, 27.4, 27.5, 27.6, 27.7, 27.8, 27.9, 27.10, 27.11, 27.12, 27.14, 27.15, 27.16, 27.17, 27.19.			
<b>CIE Assessment Pattern (50 Marks - Theory)</b>				
<b>RBT Levels</b>		<b>Marks Distribution</b>		
		<b>Test (s)</b>	<b>Qualitative Assessment (s)</b>	<b>MCQ's</b>
		<b>25</b>	<b>15</b>	<b>10</b>
<b>L1</b>	<b>Remember</b>	5	5	-
<b>L2</b>	<b>Understand</b>	5	5	-
<b>L3</b>	<b>Apply</b>	10	5	10
<b>L4</b>	<b>Analyze</b>	2.5	-	-
<b>L5</b>	<b>Evaluate</b>	2.5	-	-
<b>L6</b>	<b>Create</b>	-	-	-
<b>SEE Assessment Pattern (50 Marks - Theory)</b>				
<b>RBT Levels</b>		<b>Exam Marks Distribution (50)</b>		
<b>L1</b>	<b>Remember</b>	<b>10</b>		
<b>L2</b>	<b>Understand</b>	<b>10</b>		
<b>L3</b>	<b>Apply</b>	<b>20</b>		
<b>L4</b>	<b>Analyze</b>	<b>5</b>		
<b>L5</b>	<b>Evaluate</b>	<b>5</b>		
<b>L6</b>	<b>Create</b>	<b>-</b>		
<b>Suggested Learning Resources:</b>				
<b>Text Books:</b>				
1) B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, Forty fourth Edition, 2022, ISBN: 9788193328491.				
2) Erwin Kreyszig, Advanced Engineering Mathematics, Wiley-India Publishers, Tenth Edition, Reprint 2016, ISBN: 9788126554232.				
<b>Reference Books:</b>				
1) Glyn James, Advanced Modern Engineering Mathematics, Pearson Education, Fourth Edition, 2015, ISBN: 9780273719236.				
2) B. V. Ramana, Higher Engineering Mathematics, McGraw Hill Education (India) Private Limited, Fourth Edition, 2017, ISBN: 9780070634190.				
3) H. K. Dass, Advanced Engineering Mathematics, S. Chand & Company Ltd., Twenty Second Edition, 2018, ISBN: 9789352533831.				
4) N.P.Bali and Manish Goyal, A Text Book of Engineering Mathematics, Laxmi Publications (P) Ltd., Ninth Edition, 2014, ISBN: 9788131808320.				
<b>Web links and Video Lectures (e-Resources):</b>				
1) <a href="https://youtu.be/4lCiEnuhbA4?si=My95pvqwAMRDfjid">https://youtu.be/4lCiEnuhbA4?si=My95pvqwAMRDfjid</a>				
2) <a href="https://youtu.be/QQFIWwDA9NM?si=3wJrtlm1NdPSbXmB">https://youtu.be/QQFIWwDA9NM?si=3wJrtlm1NdPSbXmB</a>				
3) <a href="https://youtu.be/bl46OqXUtd8?si=_Po-jfjq_94X4p_0">https://youtu.be/bl46OqXUtd8?si=_Po-jfjq_94X4p_0</a>				
4) <a href="https://youtu.be/NqZUHJgitHk?si=Y6viSg1DFA4hgM9u">https://youtu.be/NqZUHJgitHk?si=Y6viSg1DFA4hgM9u</a>				
5) <a href="https://youtu.be/oPPJNoKYCro?si=A5zWC_vQqaHY7HIQ">https://youtu.be/oPPJNoKYCro?si=A5zWC_vQqaHY7HIQ</a>				
6) <a href="https://youtu.be/hll0DAilhoA?si=2dN3KfjMBy9ZGxjD">https://youtu.be/hll0DAilhoA?si=2dN3KfjMBy9ZGxjD</a>				

- 7) <https://youtu.be/x6X1P8rGXXs?si=YcmH8nxx1iQwq8mA>
- 8) <https://youtu.be/dOr0NKyD31Q?si=dMBU-BXGdGL6jIZy>
- 9) <https://youtu.be/BR1nN8DW2Vg?si=melzz97SqhK3wr-->
- 10) [https://youtu.be/ugd4k3dC\\_8Y?si=xF5U2gjIgp0woDQt](https://youtu.be/ugd4k3dC_8Y?si=xF5U2gjIgp0woDQt)
- 11) [https://youtu.be/z0Ry\\_3\\_qhDw?si=6IG2a65BZgdbaKsn](https://youtu.be/z0Ry_3_qhDw?si=6IG2a65BZgdbaKsn)
- 12) [https://youtu.be/36cAE10vpq4?si=jfR8gkFmMOckWNZ\\_](https://youtu.be/36cAE10vpq4?si=jfR8gkFmMOckWNZ_)
- 13) <https://youtu.be/vFz2FG65HBc?si=SCHi3Y1XuHWg-pPT>
- 14) <https://youtu.be/2Dsz1lZBJ3Y?si=8ATLUE-mkJSMewO3>

**Activity-Based Learning (Suggested Activities in Class)/Practical Based Learning:**

- Contents related activities (Activity-based discussions)
  - For active participation of students, instruct the students to prepare Algorithms/Flowcharts/Programming Codes
  - Organizing Group wise discussions on related topics
  - Seminars

<b>ENGINEERING THERMODYNAMICS</b>															
<b>Course Code</b>	<b>22MEE42</b>								<b>CIE Marks</b>	<b>50</b>					
<b>L:T:P:S</b>	<b>3:0:0:0</b>								<b>SEE Marks</b>	<b>50</b>					
<b>Hrs / Week</b>	<b>03</b>								<b>Total Marks</b>	<b>100</b>					
<b>Credits</b>	<b>03</b>								<b>Exam Hours</b>	<b>03</b>					
<b>Course outcomes:</b>															
At the end of the course, the student will be able to:															
22MEE42.1	Understand basic concepts of thermodynamics like systems, equilibrium, process etc. and its applications														
22MEE42.2	Apply the laws of thermodynamics to solve engineering, problems														
22MEE42.3	Identify the different types of work and heat transfer mechanisms														
22MEE42.4	Analyze reversible and irreversible process using second law and entropy concepts														
22MEE42.5	Apply the quantities used to describe the composition of a gas mixture, such as mass fraction, mole fraction, and volume fraction														
22MEE42.6	Understand the behavior of real gases at various conditions														
<b>Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:</b>															
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>	
22MEE42.1	3	3	3	-	-	-	-	-	-	-	-	-	-	3	
22MEE42.2	3	3	2	-	-	-	-	-	-	-	-	-	-	3	
22MEE42.3	3	3	3	-	-	-	-	-	-	-	-	-	-	3	
22MEE42.4	3	3	3	-	-	-	-	-	-	-	-	-	-	3	
22MEE42.5	3	3	3	-	-	-	-	-	-	-	-	-	-	3	
22MEE42.6	3	3	3	-	-	-	-	-	-	-	-	-	-	3	
<b>MODULE-1      FUNDAMENTAL CONCEPTS &amp; DEFINITIONS      22MEE42.1      8 Hours</b> <b>22MEE42.2</b>															
<b>Fundamental Concepts &amp; Definitions:</b> Microscopic and Macroscopic approaches. System and its types, Surroundings, boundary, Thermodynamic properties: definition and units, Intensive and extensive properties, quasi-static process. Thermodynamic equilibrium: definition and conditions, Zeroth law of thermodynamics. <b>Temperature:</b> concept, two-point scales and one-point scale, International fixed points. Temperature measurements, Numerical on temperature scales															
Applications		Analyze the Practical Applications of zeroth law of thermodynamics and temperature concepts.													
Text Book		Text Book 1: 1.1, 1.2, 1.3, 1.4,1.5, 2.1,2.2, 2.3 Text Book 2: 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.9, 1.11													
<b>MODULE-2      WORK AND HEAT AND FIRST LAW OF THERMODYNAMICS:      22MEE42.1      8 Hours</b> <b>22MEE42.2</b> <b>22MEE42.3</b>															
<b>Work and Heat:</b> Mechanics definition of work and its limitations. Thermodynamic definition of work; examples, sign convention. Displacement work explanation, expressions for displacement work in various processes through p-V diagrams, Problems on work transfer and heat transfer.															



<b>First Law of Thermodynamics:</b> Joules experiment, equivalence of heat and work. Statement of the First law of thermodynamics, Internal energy, prove energy is a property of the system, steady state-steady flow energy equation, Assumptions for SFEE and some important applications. Numerical on open and closed systems				
Case Study/Applications	Investigate the applications of steady flow energy equation			
Text Book	Text Book 1: 3.1, 3.2, 3.5, 3.6, 4.1, 4.2, 4.3, 5.1, 5.2 Text Book 2: 2.1, 2.2, 2.3, 3.1, 3.2, 3.3			
<b>MODULE-3</b>	<b>SECOND LAW OF THERMODYNAMICS:</b>	<b>22MEE42.2</b> <b>22MEE42.4</b>	<b>8 Hours</b>	
<b>Second Law of Thermodynamics:</b> Thermal reservoirs. Direct heat engine; schematic representation and efficiency. Reversed heat engine, schematic representation, coefficients of performance. Kelvin - Planck and Clausius statement; PMM I and PMM II, Equivalence of the two statements; Reversible and irreversible processes; factors that make a process irreversible, reversible heat engines, Carnot cycle, Numerical				
Applications	Analyze the Application of second law of thermodynamics			
Text Book	Text Book 1: 6.3, 6.4, 6.5, 6.6, 6.7, 6.8 Text Book 2: 4.1, 4.2, 4.3, 4.4, 4.5, 4.6			
<b>MODULE-4</b>	<b>ENTROPY AND PURE SUBSTANCES</b>	<b>22MEE42.4</b>	<b>8 Hours</b>	
<b>Entropy:</b> Clausius theorem, Clausius inequality; Statement, proof, application to a reversible cycle. Entropy; definition, a property, change of entropy for irreversible process, principle of increase in entropy of the universe, entropy as a quantitative test for irreversibility, Numerical <b>Pure Substances:</b> P-T and P-V diagrams, triple point and critical points. Sub cooled liquid, saturated liquid, mixture of saturated liquid and vapour, saturated vapour and superheated vapour states of pure substance with water as example. Enthalpy of change of phase (Latent heat). Dryness fraction (quality), T-S and H-S diagrams, Numerical.				
Case Study/Applications	Case study and practical applications of Entropy and pure substance concepts			
Text Book	Text Book 1: 7.4, 7.6, 7.7, 7.8, 9.1, 9.2, 9.7 Text Book 2: 5.1, 5.6, 5.7, 5.8, 7.1, 7.2, 7.3			
<b>MODULE-5</b>	<b>IDEAL GAS MIXTURES AND REAL GASES</b>	<b>22MEE42.5</b> <b>22MEE42.6</b>	<b>8 Hours</b>	
<b>Ideal gas mixtures:</b> Ideal gas mixture; Dalton's laws of partial pressures, Amagat's law of additive volumes, evaluation of mass fractions, mole fractions, Expressions for $C_P, C_V$ and Gas constant of the mixture. Numerical on mixtures. <b>Real Gases:</b> Introduction. Van-der Waal's Equation of state, Van-der Waal's constants in terms of critical properties, Law of corresponding states, compressibility factor; compressibility chart. Numerical on real gases.				
Applications	Investigate the applications of Ideal and Real gas mixtures			
Text Book	Text Book 1: 10.1, 10.2, 10.3, 10.4, 10.5 Text Book 2: 8.1, 8.2, 8.3, 8.5.			
<b>CIE Assessment Pattern (50 Marks - Theory)</b>				
<b>RBT Levels</b>		<b>Marks Distribution</b>		
		<b>Test (s)</b>	<b>Qualitative Assessment (s)</b>	<b>MCQ's</b>
		<b>25</b>	<b>15</b>	<b>10</b>
<b>L1</b>	<b>Remember</b>	5	-	-
<b>L2</b>	<b>Understand</b>	5	-	-
<b>L3</b>	<b>Apply</b>	5	5	5
<b>L4</b>	<b>Analyze</b>	5	5	5
<b>L5</b>	<b>Evaluate</b>	5	5	-
<b>L6</b>	<b>Create</b>	-	-	-
<b>SEE Assessment Pattern (50 Marks - Theory)</b>				

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	--

**Suggested Learning Resources:**

**Text Books:**

- 1) Basic and Applied Thermodynamics, P.K.Nag, Tata McGraw Hill Publication, 2nd edition, 2006, ISBN: 9780070151314.
- 2) Basic Thermodynamics, B.K Venkanna, Swati B. Wadavadagi, PHI Learning Private Limited, 2010, ISBN 13 – 9788120341128.

**Reference Books:**

- 1) Fundamentals of Engineering Thermodynamics, Moran J Shapiro., John wiley Pub.2006, ISBN – 9780470032091.
- 2) Thermodynamics, An Engineering Approach, YunusA.Cenegal and Michael A.Boles, Tata McGraw Hill publications, 2007, ISBN – 9780073305370
- 3) Fundamentals of Thermodynamics, Claus Borgnakke, Richard Edwin Sonntag, 8th Edition,WILEY, ISBN – 9781306947732

**Web links and Video Lectures (e-Resources)**

- <https://www.learnthermo.com/T1-tutorial/ch01/lesson-A/pg01.php>
- <http://www.freeonlinecoursesforall.com/2017/01/01/10-free-online-courses-on-thermodynamics/>
- <https://archive.nptel.ac.in/courses/112/105/112105123/>
- <http://www.digimat.in/nptel/courses/video/112105123/L13.html>

**Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning**

- Visit to any Thermal power plant
- Demonstration of working of IC engine/refrigerator
- Video demonstration on Laws of thermodynamics
- Contents related activities (Activity-based discussions)
  - For active participation of students, instruct the students to prepare thermodynamics related Flowcharts and Handouts
  - Organizing Group wise discussions on issues
  - Seminars

<b>ENGINEERING THERMODYNAMICS LAB</b>														
<b>Course Code</b>	22MEL42				<b>CIE Marks</b>				50					
<b>L:T:P:S</b>	0:0:1:0				<b>SEE Marks</b>				50					
<b>Hrs / Week</b>	2				<b>Total Marks</b>				100					
<b>Credits</b>	01				<b>Exam Hours</b>				03					
<b>Course outcomes:</b>														
At the end of the course, the student will be able to:														
22MEL42.1	Conduct tests to determine the properties of fuels and oils													
22MEL42.2	Analyze the area of irregular and regular surfaces using planimeter													
22MEL42.3	Investigate the viscosity of given liquid using different viscometers.													
22MEL42.4	Determine the Calorific value of solid, liquid and gaseous fuels and cloud point, pour point of the given sample													
<b>Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:</b>														
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PS01</b>	<b>PS02</b>
22MEL42.1	3	3		-	-	-	-	-	-	-	-	-	3	3
22MEL42.2	3	3	3	3	-	-	-	-	-	-	-	-	3	3
22MEL42.3	3	3			-	-	-	-	-	-	-	-	3	3
22MEL42.4	3	3	3	3	-	-	-	-	-	-	-	-	3	3
<b>Exp. No.</b>														
<b>List of Experiments</b>														
<b>Hours</b>														
<b>COs</b>														
<b>Prerequisite Experiments / Demo</b>														
	<ul style="list-style-type: none"> <li>Understand the properties of fluids</li> <li>Demonstration on working of 2-stroke engine and 4-stroke engine.</li> </ul>												2	NA
<b>PART-A</b>														
1	Determination flash point and fire point using Abel's Apparatus												2	22MEL42.1
2	Determination flash point and fire point using Pensky Marten's Apparatus												2	22MEL42.1
3	Determination flash point and fire point using Cleveland's Apparatus												2	22MEL42.1
4	Determination of area of irregular surface using Planimeter												2	22MEL42.2
5	Determination of Calorific value of solid and liquid fuels												2	22MEL42.4
6	Determination of Calorific value of gaseous fuels												2	22MEL42.4
<b>PART-B</b>														
7	Determination of viscosity of given lubricating oil using Saybolt Viscometer.												2	22MEL42.1, 22MEL42.3
8	Determination of viscosity of given lubricating oil using Redwood Viscometer.												2	22MEL42.1, 22MEL42.3
9	Determination of viscosity of given lubricating oil using Torsion Viscometer.												2	22MEL42.1, 22MEL42.3
10	Determination of cloud point of the given sample												2	22MEL42.4
11	Determination of Pour point of the given sample												2	22MEL42.4
12	Determination of property values for common refrigerants using tables												2	22MEL42.4
<b>PART-C</b>														
<b>Beyond Syllabus Virtual Lab Content</b>														
<b>(To be done during Lab but not to be included for CIE or SEE)</b>														
<ul style="list-style-type: none"> <li><a href="http://htv-au.vlabs.ac.in/heat-thermodynamics/Thermo_Couple_Seebeck_Effect/">http://htv-au.vlabs.ac.in/heat-thermodynamics/Thermo_Couple_Seebeck_Effect/</a></li> </ul>														

- <http://htv-au.vlabs.ac.in/heat-thermodynamics/Characteristics of Thermistor/>
- <http://vlabs.iitkgp.ernet.in/rtvlas/#>

**CIE Assessment Pattern (50 Marks - Lab)**

RBT Levels		Test (s)	Weekly Assessment
		20	30
L1	Remember	-	-
L2	Understand	5	5
L3	Apply	5	10
L4	Analyze	5	10
L5	Evaluate	5	5
L6	Create		

**SEE Assessment Pattern (50 Marks - Lab)**

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	10
L3	Apply	10
L4	Analyze	20
L5	Evaluate	10
L6	Create	

**Suggested Learning Resources:**

**Reference Books:**

- 1) Engineering Thermodynamics, P.K.Nag, Tata McGraw Hill Publication, 6th edition, 2017, ISBN: 9789352606429
- 2) Engineering Thermodynamics, R.K Rajput, Lakshmi Publications, 2019, ISBN 9788131800584.

<b>MANUFACTURING TECHNOLOGY</b>														
<b>Course Code</b>	<b>22MEE43</b>										<b>CIE Marks</b>	<b>50</b>		
<b>L:T:P:S</b>	<b>3:0:0:0</b>										<b>SEE Marks</b>	<b>50</b>		
<b>Hrs / Week</b>	<b>03</b>										<b>Total Marks</b>	<b>100</b>		
<b>Credits</b>	<b>03</b>										<b>Exam Hours</b>	<b>03</b>		
<b>Course outcomes:</b>														
At the end of the course, the student will be able to:														
22MEE43.1	Understand the selection of suitable moulding and casting processes													
22MEE43.2	Emphasize various concepts of forging and joining techniques for required materials.													
22MEE43.3	Analyse the tool life and tool failure during machining process													
22MEE43.4	Select the appropriate machine tools and machining operations to manufacture the components													
22MEE43.5	Apply Indexing the number of divisions on the work using various indexing techniques during gear cutting operations													
22MEE43.6	Investigate on special Moulding processes & Machines													
<b>Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:</b>														
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO 1</b>	<b>PSO 2</b>
22MEE43.1	3	3	-	-	-	-	-	-	-	-	-	-	-	3
22MEE43.2	3		-	-	-	-	-	-	-	-	-	-	-	3
22MEE43.3	3	3	-	-	-	-	-	-	-	-	-	-	-	3
22MEE43.4	3	3	-	-	-	-	-	-	-	-	-	-	2	-
22MEE43.5	3	3	-	-	-	-	-	-	-	-	-	-	2	3
22MEE43.6	3	3	-	-	-	-	-	-	-	-	-	-	2	-
<b>MODULE-1</b>	<b>CASTING &amp; MOULDING TECHNOLOGY</b>										<b>22MEE43.1</b>	<b>8 Hours</b>		
Casting by Moulding sand: Introduction to Casting process & steps involved. Mixture ingredients for different sand mixtures. Method used for sand moulding, such as Greensand, dry sand and skin dried moulds. Patterns & Cores: Definition, Need, Types, Material. Method of making patterns, cores, Binders & additives used in sand moulding. Concept of Gating & Risers: Principle and types. Casting defects: Types & methods to avoid														
Self-study / Case Study / Applications			Make a typical pattern by suitable software supported tool. (Please put only											
Text Book			Text Book 1: chapter1.1,1.2,2.1,2.2,2.3,2.4,2.5,2.6											
<b>MODULE-2</b>	<b>SPECIAL MOULDING PROCESSES</b>										<b>22MEE43.2</b>	<b>8 Hours</b>		
Special moulding Process: Study of important moulding processes, No bake moulds, Flask less moulds, Sweep mould, CO2 mould, Shell mould, Investment mould. Metal moulds: Gravity die-casting, Pressure die casting, Centrifugal casting, Squeeze Casting, Slush casting, Thixo-casting and Continuous Casting Processes. Moulding Machines: Jolt type, Squeeze type, Jolt & Squeeze type and Sand slinger, classifications of Melting Furnaces.														
Self-study / Case Study / Applications			Make a typical Sand/Metal mould by suitable moulding machine.											
Text Book			Text Book 1: chapter3.11, 3.13, 5.2											
<b>MODULE-3</b>	<b>MACHINES FOR MANUFACTURING</b>										<b>22MEE43.3, 22MEE43.4</b>	<b>8 Hours</b>		
Theory of metal cutting: Single point cutting tool nomenclature ,types of metal cutting, Mechanism of chip formation, types of chips. Tool wear and tool failure, tool life. Effects of cutting parameters on tool life. Tool failure criteria, Taylors tool life equations, numericals on tool life. Turning (lathe): classifications, Work holding devices, constructional features of turret and capstan lathe, tool														

layout. Milling machines: classification,, constructional features, milling cutters nomenclature, milling operations, up milling and down milling concept. Various milling operations, Indexing: simple, compound, differential and angular indexing calculations Drilling machine: classification, constructional features, drilling & related operations. Types of drill & drill bit nomenclature, drill materials, reaming, boring, tapping				
Self-study / Case Study / Applications	Make a typical work piece using all the Computer Numerical Controlled machining processes.			
Text Book	Text Book 2: Chapters 2.12,2.19,4.5,4.8,4.11,4.12,4.13 Text Book 3: Chapters 12.1,12.2,12.6,12.12,12.39,16.2,16.3,16.4,16.15,16.17,16.27,18.4,18.7			
<b>MODULE-4</b>	<b>WELDING &amp; JOINING TECHNIQUES</b>	<b>22MEE43.5</b>	<b>8 Hours</b>	
Welding process: Principle of welding, classification, application advantages and disadvantages, welding terminology, edge preparation. Arc welding: Arc welding process, Metal arc welding(MAW) or Flux shielded metal arc welding(FSMAW), Tungsten inert gas welding(TIG), Metal inert gas welding(MIG), Submerged arc welding(SAW), Atomic hydrogen welding(AHW). Soldering and Brazing: Surface cleaning and soldering flux, Types of soldering, advantages and disadvantages, types of brazing, advantages and disadvantages.				
Self-study / Case Study / Applications	Make a typical special welded/brazed model by suitable welding/brazing process.			
Text Book	Text Book 1: chapter 23.1, 23.2, 23.3, 23.4, 23.5, 23.6, 23.7			
<b>MODULE-5</b>	<b>FORGING TECHNOLOGY</b>	<b>22MEE43.6</b>	<b>8 Hours</b>	
Forging: Introduction, Classification of forging processes. Forging machines & equipment. Forging pressure and load in open die forging and closed die forging, concepts of friction hill and factors affecting it. Die- design parameters. Material flow lines in forging. Forging defects, Residual stresses in forging. Advantages and disadvantages of forging. Simple problems.				
Self-study / Case Study / Applications	Make a typical die forged model by suitable die forging process.			
Text Book	Text Book 4: Chapters 3.3,3.7,3.9,3.14,3.16,3.17			
<b>CIE Assessment Pattern (50 Marks - Theory)</b>				
<b>RBT Levels</b>		<b>Marks Distribution</b>		
		<b>Test (s)</b>	<b>Qualitative Assessment (s)</b>	<b>MCQ's</b>
		<b>25</b>	<b>15</b>	<b>10</b>
<b>L1</b>	<b>Remember</b>	5	-	-
<b>L2</b>	<b>Understand</b>	5	5	5
<b>L3</b>	<b>Apply</b>	5	5	5
<b>L4</b>	<b>Analyze</b>	5	5	-
<b>L5</b>	<b>Evaluate</b>	5	-	-
<b>L6</b>	<b>Create</b>	-	-	-
<b>SEE Assessment Pattern (50 Marks - Theory)</b>				
<b>RBT Levels</b>		<b>Exam Marks Distribution (50)</b>		
<b>L1</b>	<b>Remember</b>	10		
<b>L2</b>	<b>Understand</b>	20		
<b>L3</b>	<b>Apply</b>	10		

<b>L4</b>	<b>Analyze</b>	5
<b>L5</b>	<b>Evaluate</b>	5
<b>L6</b>	<b>Create</b>	--

**Suggested Learning Resources:**

**Text Books:**

- 1) Manufacturing Process-I, Dr.K.Radhakrishna, Sapna Book House, 5th Revised Edition 2017. ISBN:978-8128002076
- 2) Hazara Choudhry, 'Work shop Technology', Vol – II, Media promoters and publishers Pvt. Ltd. 2018, ISBN:9788185099156
- 3) R.K.Jain, 'Production Technology', Khanna Publishers-Delhi, 2017, ISBN:9788174090997
- 4) Manufacturing Process-III, Dr.K.Radhakrishna, Sapna Book House, 5th Revised Edition 2017. ISBN:978-8128010439

**Reference Books:**

- 1) Fundamentals of Metal machining and machine tools, G. Boothroyd , McGraw Hill, 2015, ISBN:978- 1574446593
- 2) HMT, 'Production Technology', HMT, Tata McGraw Hill, 2017. ISBN:978-0070964433

**Web links and Video Lectures (e-Resources):**

- [https://www.google.com/search?q=non+destructive+testing+videos&rlz=1C1CHBF\\_enIN959IN959&aq=non+destructive+testing+videos&aqs=chrome..69i57j0i22i30j0i390i650l3.17238j0j4&sourceid=chrome&ie=UTF-8](https://www.google.com/search?q=non+destructive+testing+videos&rlz=1C1CHBF_enIN959IN959&aq=non+destructive+testing+videos&aqs=chrome..69i57j0i22i30j0i390i650l3.17238j0j4&sourceid=chrome&ie=UTF-8)
- <https://www.youtube.com/watch?v=uTGXHxgcHCo>
- <https://www.youtube.com/watch?v=kZ7YfWW-rg0>
- <https://www.slideshare.net/anishadevarashetty/non-destructive-testing-ppt>
- [https://www.powershow.com/view2b/65bd0c-NTM1N/Non-destructive\\_testing\\_NDT\\_powerpoint\\_ppt\\_presentation](https://www.powershow.com/view2b/65bd0c-NTM1N/Non-destructive_testing_NDT_powerpoint_ppt_presentation)
- Chromeextension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.shobhituniversity.ac.in/pdf/econtent/Jitendra-J-NDET-Monograph.pdf

**Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning**

- Visit to any manufacturing/aero/auto industry or any power plant
- Demonstration of lathe/milling/drilling/CNC operations
- Demonstration of working of IC engine/refrigerator
- Demonstration of metal joining process
- Video demonstration of latest trends in mobility/robotics
- Contents related activities (Activity-based discussions)
  - For active participation of students, instruct the students to prepare Flowcharts and Handouts
  - Organizing Group wise discussions on issues
  - Seminars

<b>MANUFACTURING TECHNOLOGY LAB</b>															
<b>Course Code</b>	<b>22MEL43</b>										<b>CIE Marks</b>	<b>50</b>			
<b>L:T:P:S</b>	<b>0:0:1:0</b>										<b>SEE Marks</b>	<b>50</b>			
<b>Hrs / Week</b>	<b>02</b>										<b>Total Marks</b>	<b>100</b>			
<b>Credits</b>	<b>01</b>										<b>Exam Hours</b>	<b>03</b>			
<b>Course outcomes:</b>															
At the end of the course, the student will be able to:															
22MEL43.1	Analyze the properties of sand by determining various values from the sand tests and develop the skill towards metal joining techniques														
22MEL43.2	Apply Utilization of the patterns of different geometrical shapes for mold making and volumetric calculation in forging processes														
22MEL43.3	Apply the various lathe operations to manufacture cylindrical components														
22MEL43.4	Apply the various drilling & milling operations to machine components and make holes														
<b>Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:</b>															
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>	
22MEL43.1	3	3	3	-	-	-	-	-	-	-	-	-	3	3	
22MEL43.2	3	3	3	-	-	-	-	-	-	-	-	-	-	3	
22MEL43.3	3	3	3	-	2	-	-	-	-	-	-	-	3	-	
22MEL43.4	3	3	3	-	2	-	-	-	-	-	-	-	3	-	
<b>Exp. No.</b>	<b>List of Experiments</b>											<b>Hours</b>	<b>COs</b>		
<b>PART-A</b>															
1	<b>Foundry Models:</b> Model 1- Preparation of moulds using two moulding boxes with pattern											2	22MEL43.2		
2	Model 2- Preparation of moulds using two moulding boxes without pattern											2	22MEL43.2		
3	Permeability test and Sieve analysis test											2	22MEL43.1		
4	Clay content test and Moisture content test											2	22MEL43.1		
5	<b>Forging Models:</b> Model 1- Converting round rod to square rod											2	22MEL43.2		
6	<b>Joining Models:</b> Model 1- Soldering, Model 2- Brazing, Model 3- Electric Arc & gas welding											2	22MEL43.1		
<b>PART-B</b>															
7	Preparation of models on lathe involving facing, plain turning, step turning, taper turning, knurling and thread cutting.											2	22MEL43.3		
8	Cutting of v groove/ dovetail/ rectangular groove/gear teeth using milling/Shaping											2	22MEL43.4		
9	Preparation of models on drilling involving reaming, boring and internal thread cutting.											2	22MEL43.4		
10	Grinding of a surface using a surface grinding machine											2	22MEL43.4		
11	Milling of surfaces using both horizontal & vertical milling machines											2	22MEL43.4		
12	Demonstration of melting, pouring for casting and CNC turning and milling centres											2	22MEL43.2, 22MEL43.3		



**PART-C**  
**Beyond Syllabus Virtual Lab Content**

**(To be done during Lab but not to be included for CIE or SEE)**

- <https://smfe-iiith.vlabs.ac.in/exp/permeability/simulation.html>
- <https://ms-nitk.vlabs.ac.in/exp/fineness-modulus-of-aggregates/simulation.html>
- <http://vlabs.iitkgp.ac.in/psac/newlabs2020/vlabiitkgpAM/exp1/Webpage/index.html>
- <http://vlabs.iitkgp.ac.in/psac/newlabs2020/vlabiitkgpAM/exp2/webpage/index.html>
- <http://msvsdei.vlabs.ac.in/mem103/Unit3Simulations.php?MEM103/Unit3/Simulations/Casting.m p4>

**CIE Assessment Pattern (50 Marks – Lab)**

RBT Levels		Test (s)	Weekly Assessment
		20	30
L1	Remember		5
L2	Understand	5	5
L3	Apply	5	10
L4	Analyze	5	5
L5	Evaluate	5	5
L6	Create	-	-

**SEE Assessment Pattern (50 Marks – Lab)**

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	-

**Suggested Learning Resources:**

**Text Books:**

- 1) Manufacturing Process-I, Dr.K.Radhakrishna, Sapna Book House, 5th Revised Edition 2017.ISBN:978-8128002076
- 2) Hazara Choudhry, 'Work shop Technology', Vol – II, Media promoters and publishers Pvt. Ltd. 2018, ISBN:9788185099156
- 3) R.K.Jain, 'Production Technology', Khanna Publishers-Delhi, 2017, ISBN:9788174090997
- 4) Manufacturing Process-III, Dr.K.Radhakrishna, Sapna Book House, 5th Revised Edition 2017.ISBN:978-8128010439

<b>MECHANICAL MEASUREMENTS AND METROLOGY</b>														
<b>Course Code</b>	<b>22MEE44</b>								<b>CIE Marks</b>				<b>50</b>	
<b>L:T:P:S</b>	<b>3:0:0:0</b>								<b>SEE Marks</b>				<b>50</b>	
<b>Hrs / Week</b>	<b>03</b>								<b>Total Marks</b>				<b>100</b>	
<b>Credits</b>	<b>03</b>								<b>Exam Hours</b>				<b>03</b>	
<b>Course outcomes:</b>														
At the end of the course, the student will be able to:														
22MEE44.1	Apply the concepts of metrology to identify the suitable standards for calibrating the end bars.													
22MEE44.2	Design the gauges for engineering components using the concepts of Limits, fits, geometric dimensioning and tolerances (GD&T)													
22MEE44.3	Understand the working principle of various linear measuring instruments and principles of interference													
22MEE44.4	Analyze the various types of screw threads and gear tooth used in various applications and its measuring instruments													
22MEE44.5	Identify the surface finish on the components using various methods													
22MEE44.6	Investigate appropriate measuring instruments for measurement of force, torque, pressure, temperature and nano impact on metrology.													
<b>Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:</b>														
	<b>PO 1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PS01</b>	<b>PS02</b>
22MEE44.1	3	3	-	-	-	-	-	-	-	-	-	-	-	3
22MEE44.2	3	3	-	-	-	-	-	-	-	-	-	-	-	3
22MEE44.3	3	3	-	-	-	-	-	-	-	-	-	-	-	3
22MEE44.4	3	3	-	-	-	-	-	-	-	-	-	-	-	3
22MEE44.5	3	3	-	-	-	-	-	-	-	-	-	-	-	3
22MEE44.6	3	3	-	-	-	-	-	-	-	-	-	-	-	3
<b>MODULE-1 Standards of Measurement: 22MEE44.1 8 Hours</b>														
Definition and Objectives of metrology, Material standards-International Prototype meter, Imperial standard yard, Airy points, Wave length standard, subdivision of standards, line and end standard, calibration of end bars, Indian Standards (M-87, M- 112) of Slip gauges, Wringing phenomena, Numerical problems on building of slip gauges. Measurements and measurement systems: Generalized measurement system, basic definitions, Errors in measurement, classification of errors.														
Text Book		Text Book 1: 1.1, 1.2, 1.4, 1.5, 1.6, 1.7, 1.8, 1.10, 1.11, 1.12, 5.5, 5.7, 5.8, 5.9												
Self-study / Case Study / Applications		Case Study: subdivision of standards Applications : slip gauges												
<b>MODULE-2 Limits, Fits, Tolerance and Gauge: 22MEE44.2 8 Hours</b>														
Definition of tolerance, Specification in assembly, Principle of interchangeability and selective assembly limits of size, Indian standards, concept of limits of size and tolerances, compound tolerances, accumulation of tolerances, definition of fits, types of fits and their designation (IS 919-1963), geometrical tolerance, hole basis system, shaft basis system, classification of gauges, brief concept of design of gauges (Taylor's principles), Wear allowance on gauges, Types of gauges- plain plug gauge, ring gauge, and gauge materials.														
Text Book		Text Book 1: 2.1 to 2.11, 2.14 to 2.29												
Self-study / Case Study / Applications		Case Study: Interchangeability and selective assembly Applications : Types of gauges												
<b>MODULE-3 Comparators: 22MEE44.3, 22MEE44.4 8 Hours</b>														

<b>Introduction to comparators</b> , characteristics, classification of comparators, Johnson's Mikrokator, Sigma comparator, Dial gauge, Ziess ultra-optimizer, Solex pneumatic gauge. Principles of interference, concept of flatness, flatness testing, optical flats, optical interferometer and laser interferometer. Principle of sine bar, sine center, angle gauges, numerical on building of angles.				
Text Book	Text Book 2: 3.1 to 3.8, 3.3, 3.5, 3.7, 3.10, 3.13 to 3.16			
Self-study / Case Study / Applications	Self-study: Electrical and electronic comparators. Applications : Principle of sine bar, comparators			
<b>MODULE-4</b>	<b>Surface Metrology:</b>	<b>22MEE44.5</b>	<b>8 Hours</b>	
Surface Texture Measurement - importance of surface conditions, roughness and waviness, surface roughness standards specifying surface roughness parameters- Ra, Ry, Rz, RMS value etc., surface roughness measuring instruments - Tomlinson and Taylor Hobson versions, surface roughness symbols. Form Measurement: Terminology of screw threads, measurement of major diameter, minor diameter, pitch, angle and effective diameter of screw threads by 2-wire and 3-wire methods, best size wire. Tool maker's microscope, gear tooth terminology, gear tooth vernier caliper.				
Text Book	Text Book 1: 4.7, to 4.20 Text Book 3: 11.1, 11.2, 11.3, 11.11, 11.12.			
Self-study / Case Study / Applications	Case Study: roughness and waviness. Applications: screw threads, gear tooth vernier caliper.			
<b>MODULE-5</b>	<b>Measurement of Force, Torque, Pressure:</b>	<b>22MEE44.6</b>	<b>8 Hours</b>	
Measurement of force, torque, pressure: Principle of analytical balance, platform balance, proving ring. Torque measurement-Prony brake, hydraulic dynamometer. Pressure measurements- McLeod gauge, Pirani gauge. Measurement of Temperature: Resistance thermometers, thermocouple, law of thermo couple. Nano Impact on Metrology: Introduction, Nanotechnology, Importance of Nanometrology, Introduction to Microscopy, Principles of XRD, Bragg Law, Two-dimensional XRD System, Applications of XRD System.				
Text Book	Text Book 1: 7.1 to 7.6, 7.14, 7.15, 8.4 to 8.7, Reference text book 4: 17.1 to 17.5.4			
Self-study / Case Study / Applications	Case Study: Prony brake, hydraulic dynamometer. Applications : Two-dimensional XRD System			
<b>CIE Assessment Pattern (50 Marks - Theory)</b>				
<b>RBT Levels</b>		<b>Marks Distribution</b>		
		<b>Test (s)</b>	<b>Qualitative Assessment (s)</b>	<b>MCQ's</b>
		<b>25</b>	<b>15</b>	<b>10</b>
<b>L1</b>	<b>Remember</b>	<b>5</b>	<b>5</b>	<b>-</b>
<b>L2</b>	<b>Understand</b>	<b>5</b>	<b>5</b>	<b>5</b>
<b>L3</b>	<b>Apply</b>	<b>10</b>	<b>5</b>	<b>5</b>
<b>L4</b>	<b>Analyze</b>	<b>5</b>	<b>-</b>	<b>-</b>
<b>L5</b>	<b>Evaluate</b>	<b>-</b>	<b>-</b>	<b>-</b>
<b>L6</b>	<b>Create</b>	<b>-</b>	<b>-</b>	<b>-</b>
<b>SEE Assessment Pattern (50 Marks - Theory)</b>				
<b>RBT Levels</b>		<b>Exam Marks Distribution (50)</b>		
<b>L1</b>	<b>Remember</b>	<b>5</b>		
<b>L2</b>	<b>Understand</b>	<b>5</b>		
<b>L3</b>	<b>Apply</b>	<b>15</b>		
<b>L4</b>	<b>Analyze</b>	<b>15</b>		
<b>L5</b>	<b>Evaluate</b>	<b>10</b>		
<b>L6</b>	<b>Create</b>	<b>--</b>		

## **Suggested Learning Resources:**

### **Text Books:**

- 1) Dr. T Chandrashekar, 'Metrology and Measurement', Subhas publication, 2017, ISBN: 9789383214198.
- 2) Beckwith Marangoni and Lienhard, 'Mechanical Measurements', Pearson Education, 7th Edition, 2015, ISBN 13: 978-8131717189.
- 3) R.K. Jain, 'Engineering Metrology', Khanna Publishers, 2017, ISBN-13: 978-8174091536.

### **Reference Books:**

- 1) I.C. Gupta, 'Engineering Metrology', Dhanpat Rai Publications, Delhi, 8th Edition, 2018, ISBN 13: 9788189928452.
- 2) R.K. Jain, 'Mechanical and Industrial Measurements', Khanna Publishers, 2008, ISBN: 9788174091918. 3) Anand K. Bewoor & Vinay A. Kulkarni, 'Metrology & Measurement', Tata McGraw Hill Pvt. Ltd., New Delhi, 2009, ISBN: 9781259081323.
- 3) N V Raghavendra and Krishnamurthy, 'Engineering Metrology and Measurement', Oxford University Press, 2013, ISBN: 9780198085492.

### **Web links and Video Lectures (e-Resources):**

- <https://archive.nptel.ac.in/courses/112/104/112104250/>
- <https://archive.nptel.ac.in/courses/112/106/112106138/>
- <https://www.youtube.com/watch?v=BqAmLOI8uzs>
- <https://www.youtube.com/watch?v=X8KPNVZhvm0>

### **Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning**

- Visit to any manufacturing/aero/auto industry.
- Demonstration of inspection tool used for machining operations
- Demonstration of sensors.
- Video demonstration of latest trends in Comparators
- Contents related activities (Activity-based discussions)
  - For active participation of students, instruct the students to prepare Flowcharts and Handouts
  - Organizing Group wise discussions on issues
  - Seminars

<b>MECHANICAL MEASUREMENTS AND METROLOGY LAB</b>															
<b>Course Code</b>	<b>22MEL44</b>									<b>CIE Marks</b>	<b>50</b>				
<b>L:T:P:S</b>	<b>0:0:1:0</b>									<b>SEE Marks</b>	<b>50</b>				
<b>Hrs / Week</b>	<b>2</b>									<b>Total Marks</b>	<b>100</b>				
<b>Credits</b>	<b>01</b>									<b>Exam Hours</b>	<b>03</b>				
<b>Course outcomes:</b>															
At the end of the course, the student will be able to:															
22MEL44.1	Investigate the measuring instruments such as micrometer, pressure gauge, LVDT, load cell, thermocouple, strain gauge etc ...														
22 MEL44.2	Determine the taper angle, surface roughness and alignment of machined components														
22 MEL44.3	Analyze the screw thread and gear tooth parameters of the specimens														
22 MEL4.4	Compute the cutting forces and torque in drilling and turning using dynamometers														
<b>Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:</b>															
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PS01</b>	<b>PS02</b>	
											<b>1</b>				
22MEL44.1	3	-	-	-	-	-	-	-	2	-	-	-	1	-	
22 MEL44.2	3	-	-	-	-	-	-	-	2	-	-	-	-	2	
22 MEL44.3	3	2	-	-	-	-	-	-	2	-	-	-	-	2	
22 MEL44.4	3	2	-	-	-	-	-	-	2	-	-	-	1	2	
<b>Exp. No.</b>	<b>List of Experiments</b>										<b>Hours</b>	<b>COs</b>			
<b>Prerequisite Experiments / Demo</b>															
	<ul style="list-style-type: none"> <li>Demonstration on measuring devices</li> </ul>										2	NA			
<b>PART-A</b>															
1	Calibration of load cell using standard weights										2	22MEL44.1			
2	Calibration of micrometer using slip gauge										2	22MEL44.1			
3	Calibration of LVDT using micrometer										2	22MEL44.1			
4	Calibration of pressure gauge										2	22MEL44.1			
5	Measurement of Taper angle using sine bar and slip gauge										2	22MEL44.2			
6	Measurement of surface roughness of a component using mechanical comparator										2	22MEL44.2			
<b>PART-B</b>															
7	Measurement of a screw thread parameters using floating carriage micrometer by 2-wire method										2	22MEL44.3			
8	Measurement of gear parameters using gear tooth vernier										2	22MEL44.3			
9	Measurement of alignment of surface plate using roller set										2	22MEL44.2			
10	Comparison and measurement of temperature using thermocouple and RTD										2	22MEL44.1			
11	Measurement of cutting forces and torque using lathe/ drill tool Dynamometer										2	22MEL44.4			
12	Determination of young's modulus using strain gauge.										2	22MEL44.1			
<b>PART-C</b>															
<b>Beyond Syllabus Virtual Lab Content</b>															
<b>(To be done during Lab but not to be included for CIE or SEE)</b>															

- 1) <https://sl-coep.vlabs.ac.in/List%20of%20experiments.html>
- 2) <http://mech.sliet.ac.in/laboratories/precision-metrology-measurement-lab/>
- 3) <https://kcgcollege.ac.in/Virtual-Lab/Mechanical/Exp-3/theory.html>
- 4) <https://github.com/virtual-labs/exp-measurement-gear-tooth-vernier-iitkgp>
- 5) <https://github.com/virtual-labs/exp-measurement-screw-threads-iitkgp>
- 6) <https://github.com/virtual-labs/exp-measurement-displacement-lvdt-iitkgp>

**CIE Assessment Pattern (50 Marks - Lab)**

RBT Levels		Test (s)	Weekly Assessment
		20	30
L1	Remember	-	5
L2	Understand	-	5
L3	Apply	10	10
L4	Analyze	10	10
L5	Evaluate	-	-
L6	Create	-	-

**SEE Assessment Pattern (50 Marks - Lab)**

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	-

**Suggested Learning Resources:**

**Reference Books:**

- 1) I.C. Gupta, 'Engineering Metrology', Dhanpat Rai Publications, Delhi, 8th Edition, 2018, ISBN 13: 9788189928452.
- 2) R.K. Jain, 'Mechanical and Industrial Measurements', Khanna Publishers, 2008, ISBN: 9788174091918.
- 3) Anand K. Bewoor & Vinay A. Kulkarni, 'Metrology & Measurement', Tata McGraw Hill Pvt. Ltd., New Delhi, 2009, ISBN: 9781259081323.
- 4) N V Raghavendra and Krishnamurthy, 'Engineering Metrology and Measurement', Oxford University Press, 2013, ISBN: 9780198085492.

## PROGRAMMING FOR IoT

<b>Course Code</b>	<b>22MEE451</b>	<b>CIE Marks</b>	<b>50</b>
<b>L:T:P:S</b>	<b>3:0:0:0</b>	<b>SEE Marks</b>	<b>50</b>
<b>Hrs. / Week</b>	<b>03</b>	<b>Total Marks</b>	<b>100</b>
<b>Credits</b>	<b>03</b>	<b>Exam Hours</b>	<b>03</b>

### Course Outcomes:

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

22MEE451.1	Understand the fundamentals of Embedded system and microcontrollers.
22MEE451.2	Apply the concept of Embedded System for its Software development.
22MEE451.3	Analyze the Linux operating system and Wi-Fi for raspberry pi.
22MEE451.4	Enable to configure various Sensors and Actuators, Memory, Communication Interface I2C
22MEE451.5	Evaluate the Architecture and features of Raspberry Pi and become familiar with the design aspects of I/O and Memory Interfacing circuits.
22MEE451.6	Apply modern tools to acquire competency in various storage devices and apply the knowledge gained in designing websites.

### Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22MEE451.1	3	-	-	-	-	-	-	-	-	-	-	2	3	-
22MEE451.2	-	3	-	-	3	-	-	-	-	-	-	2	3	2
22MEE451.3	-	-	3	-	-	-	-	-	-	-	-	2	3	3
22MEE451.4	-	-	-	3	3	-	-	-	-	-	-	2	3	3
22MEE451.5	-	-	-	-	3	-	-	-	-	-	-	2	3	3
22MEE451.6	-	-	-	-	3	-	-	-	-	-	-	2	3	3

### MODULE-1

### INTRODUCTION TO EMBEDDED SYSTEMS

**22MEE451.1**

**8 Hours**

Importance of Embedded Systems, Embedded Systems Vs. General Computing Systems, Classification of Embedded System, Major Application areas of Embedded System, Purpose of Embedded System, and The Innovative Bonding of lifestyle with Embedded Technology, CISC vs. RISC, fundamentals of Von-Neumann/Harvard architectures, Types and selection of Microcontrollers.

Case Study: Make a brief report on Introduction to IoT with the different selection of micro controllers.

Text Book: Text Book 1: 3.1, 3.2

### MODULE-2

### OS INSTALLATION & Wi-Fi SET UP FOR RASPBERRY Pi

**22MEE451.2**

**8 Hours**

Download of Linux OS Latest version, installation, and partitioning, Embedded development environment - GNU debugger - tracing & profiling tools - binary utilities - kernel debugging - debugging embedded Linux applications - porting Linux - Linux and real time - SDRAM interface, Wireless connection using Wi-Fi for raspberry pi.

Case Study	Hands-on with Raspberry Pi Tools			
Text Book	Text Book 1: 14,15			
<b>MODULE-3</b>	<b>I/O &amp; SERIAL PROTOCOL PROGRAMMING</b>	<b>22MEE451.3</b>	<b>8 Hours</b>	
<p><b>I/O &amp; Serial protocol programming for Embedded development</b>  Core of the Embedded System, Sensors and Actuators, Memory, Communication Interface, Embedded Firmware, Other System Components Characteristics and Quality Attributes of Embedded Systems: Characteristics of an embedded system, quality attributes of embedded system.  <b>Understanding I2C and I2C Interface, programming I2C</b> Understanding of serial communication protocol I2C, Details of sensors and actuator using I2C protocol, APIs to configure the I2C module on raspberry-pi and communicate to other devices over I2C, Programming the GPIO and interfacing peripherals With Raspberry Pi, Boot Process of Raspberry-Pi.</p>				
Case Study	Programming for Embedded development			
Text Book	Text Book 1:13.1-13.5			
<b>MODULE-4</b>	<b>INTRODUCTION TO SINGLE BOARD COMPUTER</b>	<b>22MEE451.4</b>	<b>8 Hours</b>	
<p>Types of Processors, Advantages and Applications of Raspberry Pi.  Introduction to Embedded Software Development, Compiling the applications, software flow, input, output and peripheral accesses, Microcontroller interfaces.  Raspberry Pi board and its Data Sheet, Client-Server programming</p>				
Case Study	Raspberry Pi board data sheet, Using libcurl (for JSON objects), Boot Process of Raspberry-Pi, Client-Server programming.			
Text Book	Text Book 1: 5.1-5.5			
<b>MODULE-5</b>	<b>SINGLE BOARD COMPUTER AND PERIPHERALS INTERFACING</b>	<b>22MEE451.5. 22MEE451.6</b>	<b>8 Hours</b>	
<p>Lego Train's IR protocol("LPF RC Protocol": LEGO Power Function RC Protocol), I2C GPIO expander board(using MCP23017), I2C GPIO Expander IC MCP23017/MCP23S17, Sample code to use I2C GPIO Expander, Understanding Stepper Motor, Using LDR Sensor Module with Raspberry Pi, BCM2835-ARM-Peripherals, <u>BCM-2835 SOC details</u>.</p>				
Case Study	Hands-on with IR/RC protocols, Generating PWM signals through the Pi.			
Text Book	Text Book 1: 6.1, 6.2, 7.1, 7.2			
<b>CIE Assessment Pattern (50 Marks - Theory) -</b>				
<b>RBT Levels</b>		<b>Marks Distribution</b>		
		<b>Test (s)</b>	<b>Qualitative Assessment (s)</b>	<b>MCQ's</b>
		<b>25</b>	<b>15</b>	<b>10</b>
<b>L1</b>	<b>Remember</b>	5	-	-
<b>L2</b>	<b>Understand</b>	5	-	-
<b>L3</b>	<b>Apply</b>	5	5	-
<b>L4</b>	<b>Analyze</b>	5	5	5
<b>L5</b>	<b>Evaluate</b>	5	5	5
<b>L6</b>	<b>Create</b>	-	-	-



**SEE Assessment Pattern (50 Marks - Theory)**

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	-

**Suggested Learning Resources:****Text Books:**

- 1) Introduction to Embedded Systems, Shibu K V, 2009, TMH.
- 2) Embedded Systems – A contemporary Design Tool, James K Peckol, 2014, John Wiley.

**Reference Books:**

- 1) Microprocessors and Interfacing – Programming & Hardware Douglas Hall, 2nd edition, 1990, McGraw Hill.
- 2) Microprocessors and Microcontrollers: Architecture, Programming and System Design, Krishna Kant, 2007, PHI.
- 3) The Intel Microprocessors Architecture, Programming and Interfacing, Barry B. Brey, 2007, Pearson Education.

**Web links and Video Lectures (e-Resources):**

- [Hands-on with the Raspberry Pi 3 Model](#)
- <https://devopedia.org/programming-for-iot>
- <https://www.raspberrypi.org/>

**Activity-Based Learning (Suggested Activities in Class)/ Practical Based Learning**

- Visit to any Manufacturing Industry
- Video demonstration of latest trends in IoT Platforms.
- Contents related activities (Activity-based discussions)
  - For active participation of students, instruct the students to prepare Flowcharts and Handouts
  - Organizing Group wise discussions on issues

<b>ESSENTIAL OF CYBER SECURITY</b>															
<b>Course Code</b>	<b>22MEE452</b>										<b>CIE Marks</b>	<b>50</b>			
<b>L:T:P:S</b>	<b>3:0:0:0</b>										<b>SEE Marks</b>	<b>50</b>			
<b>Hrs / Week</b>	<b>03</b>										<b>Total Marks</b>	<b>100</b>			
<b>Credits</b>	<b>03</b>										<b>Exam Hours</b>	<b>3 Hrs.</b>			
<b>Course outcomes:</b>															
At the end of the course, the student will be able to:															
22MEE452.1	Analyse cyber-attacks, cybercrimes, cyber.														
22MEE452.2	Understand how to protect themselves from such attacks.														
22MEE452.3	Explain network web security protocols of SSL, TLS, HTTPS, SSH.														
22MEE452.4	Understand the concepts of IP security and ESP.														
22MEE452.5	Design and develop secure software modules.														
22MEE452.6	Evaluate the Legal Aspects of Cyber Crime														
<b>Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:</b>															
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>	
22MEE452.1	3	-	-	-	-	-	-	-	-	-	-	2	3	-	
22MEE452.2	-	3	-	-	3	-	-	-	-	-	-	2	3	2	
22MEE452.3	-	-	3	-	-	-	-	-	-	-	-	2	3	3	
22MEE452.4	-	-	-	3	3	-	-	-	-	-	-	2	3	3	
22MEE452.5	-	-	-	-	3	-	-	-	-	-	-	2	3	3	
22MEE452.6	-	-	-	-	3	-	-	-	-	-	-	2	3	3	
<b>MODULE-1 INTRODUCTION TO CYBER SECURITY 22MEE452.1, 22MEE452.2 8 Hrs.</b>															
Basic Cyber Security Concepts, layers of security, Vulnerability, Threat, Harmful acts, Internet Governance – Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threat, motive of attackers, Active attacks, Passive attacks, Software attacks, Hardware attacks, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc., Comprehensive Cyber Security Policy.															
Case Study	Make a Report on any 1 case related to the current module.														
Text Book	Text Book 2: Ch 1														
<b>MODULE-2 CYBERCRIME: E-MAIL SECURITY 22MEE452.3 8 Hrs.</b>															
Pretty Good Privacy, Domain keys identified mail, S/MIME															
Case Study	Make a Report on any 1 case related to the current module.														
Text Book	Text Book 2: Ch 21, 22														

<b>MODULE-3</b>	<b>CYBERCRIME: TRANSPORT LEVEL SECURITY</b>	<b>22MEE452.4</b>	<b>8 Hrs.</b>
Web Security considerations, Transport layer Security, Secure Sockets layer, HTTPS, Secure Shell (SSH)			
Case Study	Make a Report on any 1 case related to the current module.		
Text Book	Text Book 2: Ch 21, 22, 24		
<b>MODULE-4</b>	<b>CYBERCRIME: IP SECURITY</b>	<b>22MEE452.5</b>	<b>8 Hrs.</b>
IP security overview, Combining Security Associations Internet Key Exchange, Encapsulation Security Payload (ESP), Cryptographic suites.			
Case Study	Make a Report on any 1 case related to the current module.		
Text Book	Text Book 2: Ch 21, 22, 23, 24		
<b>MODULE-5</b>	<b>CYBERCRIME &amp; CYBER SECURITY: LEGAL ASPECTS</b>	<b>22MEE452.6</b>	<b>8 Hrs.</b>
Basic Data Privacy Concepts: Fundamental Concepts, Data Privacy Attacks, Data-linking and profiling, privacy policies and their specifications, privacy policy languages, privacy in different domains- medical, financial, etc.,			
Case Study	Make a Report on any 1 case related to the current module.		
Text Book	Text Book 2: Ch 24		
<b>CIE Assessment Pattern (50 Marks - Theory) -</b>			
		<b>Marks Distribution</b>	
<b>RBT Levels</b>		<b>Test (s)</b>	<b>Qualitative Assessment (s)</b>
		<b>25</b>	<b>15</b>
<b>L1</b>	<b>Remember</b>	5	-
<b>L2</b>	<b>Understand</b>	5	-
<b>L3</b>	<b>Apply</b>	5	5
<b>L4</b>	<b>Analyze</b>	5	5
<b>L5</b>	<b>Evaluate</b>	5	-
<b>L6</b>	<b>Create</b>	-	-
<b>SEE Assessment Pattern (50 Marks - Theory) -</b>			
<b>RBT Levels</b>		<b>Exam Marks Distribution (50)</b>	
<b>L1</b>	<b>Remember</b>	<b>10</b>	
<b>L2</b>	<b>Understand</b>	<b>10</b>	
<b>L3</b>	<b>Apply</b>	<b>10</b>	
<b>L4</b>	<b>Analyze</b>	<b>10</b>	
<b>L5</b>	<b>Evaluate</b>	<b>10</b>	
<b>L6</b>	<b>Create</b>	<b>--</b>	

**Suggested Learning Resources:****Text Books:**

1. "Cyber Security, Understanding Cybercrimes, Computer Forensics and Legal Perspectives", By Nina Godbole, Sunit Belapure, Wiley Publications, Reprint 2016.
2. "Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives, By B. B. Gupta, D. P. Agrawal, Haoxiang Wang CRC Press, ISBN 9780815371335, 2018.

**Reference Books:**

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.
2. Cybersecurity for Dummies, Brian Underdahl, Wiley, 2011.
3. Introduction to Cyber Security, Chwan-Hwa (John) Wu, J. David Irwin, CRC Press T & F Group.

**Web links and Video Lectures (e-Resources):**

- Computer-Security  
[https://en.wikipedia.org/wiki/Computer\\_security](https://en.wikipedia.org/wiki/Computer_security)
- Cyber Security Issues in India – Online Safety in India  
[https://www.childlineindia.org/a/issues/online-safety?gad=1&gclid=CjwKCAjwsKqoBhBPEiwALrrqiR30qi5hXPX8SWC8v2BFci8mAjpvSB7XKK9vb3UR6bjwCk9ZtFXFhoCnIMQAvD\\_BwE](https://www.childlineindia.org/a/issues/online-safety?gad=1&gclid=CjwKCAjwsKqoBhBPEiwALrrqiR30qi5hXPX8SWC8v2BFci8mAjpvSB7XKK9vb3UR6bjwCk9ZtFXFhoCnIMQAvD_BwE)
- Cyber threats and security – National cyber security  
[https://www.1600avenue.com/1600-npcc-communities-nonprofits?gclid=CjwKCAjwsKqoBhBPEiwALrrqiDaeW\\_fhdqbqrbXRtg\\_A8M0ECYzYR6R7iNvd1OH-WzEaOwHpKEYQdsBoCvVMQAvD\\_BwE](https://www.1600avenue.com/1600-npcc-communities-nonprofits?gclid=CjwKCAjwsKqoBhBPEiwALrrqiDaeW_fhdqbqrbXRtg_A8M0ECYzYR6R7iNvd1OH-WzEaOwHpKEYQdsBoCvVMQAvD_BwE)
- Cyber Security Assignment  
<https://www.scribd.com/document/328628763/Cyber-Security-Assignment>

**Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning****Cybercrime:****Examples and Mini-Cases Examples:**

- Official Website of Maharashtra Government Hacked,
- Indian Banks Lose Millions of Rupees,
- Parliament Attack,
- Pune City Police Bust Nigerian Racket,
- e-mail spoofing instances.
- Mini-Cases: The Indian Case of online Gambling,
- An Indian Case of Intellectual Property Crime,
- Financial Frauds in Cyber Domain.

<b>INTRODUCTION TO MACHINE LEARNING</b>														
<b>Course Code</b>	<b>22MEE453</b>					<b>CIE Marks</b>					<b>50</b>			
<b>L:T:P:S</b>	<b>3:0:0:0</b>					<b>SEE Marks</b>					<b>50</b>			
<b>Hrs. / Week</b>	<b>03</b>					<b>Total Marks</b>					<b>100</b>			
<b>Credits</b>	<b>03</b>					<b>Exam Hours</b>					<b>03</b>			
<b>Course Outcomes:</b>														
At the end of the course, the student will be able to:														
22MEE453.1	Understand the fundamentals of Machine Learning and apply basics of Python Programming to solve ML Algorithms.													
22MEE453.2	Apply the fundamental concepts of Linear Regression in Supervised Learning.													
22MEE453.3	Apply the fundamental concepts of Logistic Regression in Supervised Learning.													
22MEE453.4	Design a model using Supervised ML algorithms for Classification, Prediction and Clustering.													
22MEE453.5	Evaluate the Performance Metrics of all ML algorithms in Unsupervised Learning.													
22MEE453.6	Analyze the concepts of Reinforcement Learning.													
<b>Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:</b>														
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>
22MEE453.1	3	-	-	-	-	-	-	-	-	-	-	2	3	-
22MEE453.2	-	3	-	-	3	-	-	-	-	-	-	2	3	2
22MEE453.3	-	-	3	-	-	-	-	-	-	-	-	2	3	3
22MEE453.4	-	-	-	3	3	-	-	-	-	-	-	2	3	3
22MEE453.5	-	-	-	-	3	-	-	-	-	-	-	2	3	3
22MEE453.6	-	-	-	-	3	-	-	-	-	-	-	2	3	3
<b>MODULE-1</b>														
<b>FUNDAMENTALS OF ML</b>					<b>22MEE453.1</b>					<b>8 Hours</b>				
Meaning, Definition, Google Vs AI, Approach of ML, ML processes, Applications of ML, Types of ML with examples, ML Techniques, Qualitative and quantitative data, LDA. <b>Basics of Python Programming:</b> Python datatypes, Data handling with python, NumPy, Pandas, Matplotlib, Decision and control loops.														
Case Study		Simple Linear Regression Examples.												
Text Book		Text Book 1: 2.1-2.5												
<b>MODULE-2</b>														
<b>SUPERVISED LEARNING-I</b>					<b>22MEE453.2, 22MEE453.3</b>					<b>8 Hours</b>				
<b>Linear Regression</b> – SLR and MLR Model building, Estimation of parameters using OLS, Performance Evaluation- Confusion Matrix, Accuracy, Precision, Recall, ROC Curves, Support vector mechanics (SVM), Non-linear SVM, Kernel functions. <b>Logistic Regression</b> – Introduction, Binary logical regression, Estimation of parameters, Sensitivity, Specificity, Multi-class classification, One Vs One, One Vs Rest, Gain chart, Lift chart.														
Case Study		Multi Linear Regression Examples.												
Text Book		Text Book 2: Pg. 21, 93												
<b>MODULE-3</b>														
<b>SUPERVISED LEARNING-II</b>					<b>22MEE453.4</b>					<b>8 Hours</b>				

Concept and terminology, Decision Trees, Classification and Regression tree (CART), Gini gain, Entropy & Information gain computation, RF- Algorithm, Cost Functions- MSE, MAE, R-Square, Estimation of values of regression coefficients, Naive Bayes classifier, KNN for classification, Overfitting, Underfitting, Bias and Variance.

Case Study

Decision Tree Examples

Text Book

Text Book 1: 3.1-3.7, Text Book 2: Pg. 49, 213

**MODULE-4**

**UNSUPERVISED LEARNING**

**22MEE453.5**

**8 Hours**

Distance-based models, Distance Metrics, Clustering, k-means clustering, Algorithm, Principle Component Analysis (PCA).

Case Study

Logistic Regression Examples.

Text Book

Text Book 2: Pg. 115, 161

**MODULE-5**

**REINFORCEMENT LEARNING**

**22MEE453.6**

**8 Hours**

**Reinforcement Learning:** Active and Passive RL, Learning from rewards, Generalization concept, Inverse RL, Application learning Task, q-Learning.

Case Study

Logistic Regression Examples.

Text Book

Text Book 1-13.1-13.8, Text Book 2- pg.517

**CIE Assessment Pattern (50 Marks - Theory) -**

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)	MCQ's
		25	15	10
L1	Remember	5	-	-
L2	Understand	5	-	-
L3	Apply	5	5	-
L4	Analyze	5	5	5
L5	Evaluate	5	5	5
L6	Create	-	-	-

**SEE Assessment Pattern (50 Marks - Theory) -**

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	-

**Suggested Learning Resources:**

**Text Books:**

- 1) "Machine Learning", By Tom Mitchell, McGraw Hill, 2017.
- 2) "Introduction to Machine Learning", By E. Alpaydin, PHI, 2005.

**Reference Books:**

- 1) "Introduction to Machine Learning with Python", By Andreas Muller, Shroff/O'Reilly, 2016, ISBN: 978-9352134571.
- 2) "Hands-On Machine Learning with Scikit-Learn and Tensor Flow", By Shroff/O'Reilly, 2017.

**Web links and Video Lectures (e-Resources):**

- [https://onlinecourses.nptel.ac.in/noc23\\_cs11/unit?unit=16&lesson=17](https://onlinecourses.nptel.ac.in/noc23_cs11/unit?unit=16&lesson=17)
- <https://www.ibm.com/topics/machine-learning>
- <https://www.geeksforgeeks.org/machine-learning/>

**Activity-Based Learning (Suggested Activities in Class)/ Practical Based Learning**

- Visit to any Manufacturing/Aero/Auto Industry
- Video demonstration of latest trends in mobility/robotics
- Contents related activities (Activity-based discussions)
  - For active participation of students, instruct the students to prepare Flowcharts and Handouts
  - Organizing Group wise discussions on issues
  - Seminars

<b>ROBOTICS PROGRAMMING</b>																
<b>Course Code</b>	<b>22MEE454</b>						<b>CIE Marks</b>	<b>50</b>								
<b>L:T:P:S</b>	<b>3:0:0:0</b>						<b>SEE Marks</b>	<b>50</b>								
<b>Hrs / Week</b>	<b>03</b>						<b>Total Marks</b>	<b>100</b>								
<b>Credits</b>	<b>03</b>						<b>Exam Hours</b>	<b>03</b>								
<b>Course outcomes:</b>																
At the end of the course, the student will be able to:																
22MEE454.1	Understand the robotics design and implementation															
22MEE454.2	Apply the knowledge on fundamentals of robotic programming															
22MEE454.3	Analyse the behaviour of different types of sensors and actuators															
22MEE454.4	Understand the ROS fundamentals															
22MEE454.5	Design robotic applications using ROS															
22MEE454.6	Design products by suitable integration of Arduino and Raspberry Pi boards with ROS															
<b>Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:</b>																
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO 1</b>	<b>PSO 2</b>		
22MEE454.1	3	3	-	-	-	-	-	-	-	-	-	-	-	3		
22MEE454.2	3	-	-	-	-	-	-	-	-	-	-	-	-	3		
22MEE454.3	3	3	-	-	-	-	-	-	-	-	-	-	-	3		
22MEE454.4	3	3	-	-	-	-	-	-	-	-	-	-	2	-		
22MEE454.5	3	3	-	-	-	-	-	-	-	-	-	-	2	3		
22MEE454.6	3	3	-	-	-	-	-	-	-	-	-	-	2			
<b>MODULE-1 INTRODUCTION TO ROBOTICS AND PROGRAMMING BASICS</b>																
						<b>22MEE454.1</b>						<b>22MEE454.2</b>			<b>8 Hours</b>	
Introduction to robotics and its applications. Understanding the components of a robot. Introduction to programming languages (Python, C++, etc.). Setting up the development environment.																
Self-study / Case Study / Applications			Writing and executing simple programs													
Text Book			Text Book 1: Chapter 1, 2													
<b>MODULE-2 ROBOT KINEMATICS AND MOTION CONTROL</b>																
						<b>22MEE454.1</b>						<b>22MEE454.2</b>			<b>8 Hours</b>	
Basics of robot kinematics, Forward and inverse kinematics, End-effector control and tool frames, Trajectory planning and motion control																
Self-study / Case Study / Applications			Programming robot movements													
Text Book			Text Book 3,4: Chapter 1, 2													
<b>MODULE-3 SENSORS AND PERCEPTION</b>																
						<b>22MEE454.1,</b>						<b>22MEE454.3</b>			<b>8 Hours</b>	
Types of sensors in robotics (IR, ultrasonic, camera, etc.). Sensor data processing and filtering. Introduction to computer vision for robots. Object detection and tracking.																
Self-study / Case Study / Applications			Integrating sensors for environment perception													
Text Book			Text Book 2: Chapter 1, 2, 3													
<b>MODULE-4 ROS FUNDAMENTALS</b>																
						<b>22MEE454.4</b>						<b>8 Hours</b>				



			<b>22MEE454.5</b>	
Ubuntu Linux for Robotics-Ubuntu Graphical User Interface, Shell Commands, C++ and Python for Robotic Programming- Basic Concepts with Examples				
Self-study / Case Study / Applications	Simulating path planning and localization			
Text Book	Text Book 1,2: Chapter 4, 5			
<b>MODULE-5</b>	<b>ROS PROGRAMMING</b>		<b>22MEE454.6</b>	<b>8 Hours</b>
Creating ROS Workspace and Package, Using ROS Client Libraries, Programming Embedded Board using ROS-Interfacing Arduino with ROS, ROS on a Raspberry Pi				
Self-study / Case Study / Applications	Design and program a robotic task			
Text Book	Text Book 1,2: Chapter 5,6			
<b>CIE Assessment Pattern (50 Marks - Theory)</b>				
<b>RBT Levels</b>		<b>Marks Distribution</b>		
		<b>Test (s)</b>	<b>Qualitative Assessment (s)</b>	<b>MCQ's</b>
		<b>25</b>	<b>15</b>	<b>10</b>
<b>L1</b>	<b>Remember</b>	5	-	-
<b>L2</b>	<b>Understand</b>	5	5	5
<b>L3</b>	<b>Apply</b>	5	5	5
<b>L4</b>	<b>Analyze</b>	5	5	-
<b>L5</b>	<b>Evaluate</b>	5	-	-
<b>L6</b>	<b>Create</b>	-	-	-
<b>SEE Assessment Pattern (50 Marks - Theory)</b>				
<b>RBT Levels</b>		<b>Exam Marks Distribution (50)</b>		
<b>L1</b>	<b>Remember</b>	10		
<b>L2</b>	<b>Understand</b>	20		
<b>L3</b>	<b>Apply</b>	10		
<b>L4</b>	<b>Analyze</b>	5		
<b>L5</b>	<b>Evaluate</b>	5		
<b>L6</b>	<b>Create</b>	--		
<b>Suggested Learning Resources:</b>				
<b>Text Books:</b>				
1. Jonathan Cacace; Lentin Joseph, Mastering ROS for Robotics Programming: Design, build, and simulate complex robots using the Robot Operating System, 2 <sup>nd</sup> Edition, PacktPublishing, 2018.				
2. Sebastian Thrun, Wolfram Burgard, and Dieter Fox for "Probabilistic Robotics", MIT Press 2015				
3. Kevin M. Lynch, Frank C. Park for Modern Robotics: Mechanics, Planning, and Control, Cambridge University Press, 2017				
4. Bruno Siciliano, Lorenzo Sciavicco, Luigi Villani, Giuseppe Oriolo for Robotics: Modelling, Planning and Control, Springer Science & Business Media, 2020				
<b>Reference Books:</b>				
1. Hughes, C. and Hughes, T., Robot programming: a guide to controlling autonomous robots. Que Publishing, 2016				
2. Quigley, M., Gerkey, B. and Smart, W.D., Programming Robots with ROS: a practical introduction to the Robot Operating System. " O'Reilly Media, Inc.", 2015				

3. Anil Mahtani, Luis Sanchez, Enrique Fernandez, Aaron Martinez, Lentin Joseph. ROS Programming: Building Powerful Robots. Packt Publishing, 2018.
4. Lentin Joseph, Robot Operating System (ROS) for Absolute Beginners: Robotics Programming Made Easy, 1<sup>st</sup> Edition, APress, 2018.

**Web links and Video Lectures (e-Resources):**

- <https://www.youtube.com/watch?v=pwwVOpXrazs&list=PL4g1oAdmuCfqmYvURLzVFkMMUI7839biN>
- <https://www.youtube.com/watch?v=gizihSJ63o4&list=PL4g1oAdmuCfqmYvURLzVFkMMUI7839biN&index=2>
- <https://www.youtube.com/watch?v=BnzUXag1qx8&list=PL4g1oAdmuCfqmYvURLzVFkMMUI7839biN&index=3>
- <https://www.youtube.com/watch?v=7mm4ig8Lyc8&list=PL4g1oAdmuCfqmYvURLzVFkMMUI7839biN&index=5>
- [https://www.youtube.com/watch?v=RBD9LflfkxA&list=PLQ3sZ7NCnFIEej8AWH\\_Bf09W7xlirvK6l&index=43](https://www.youtube.com/watch?v=RBD9LflfkxA&list=PLQ3sZ7NCnFIEej8AWH_Bf09W7xlirvK6l&index=43)
- [https://www.youtube.com/watch?v=E2nnohpDw5k&list=PLQ3sZ7NCnFIEej8AWH\\_Bf09W7xlirvK6l&index=44](https://www.youtube.com/watch?v=E2nnohpDw5k&list=PLQ3sZ7NCnFIEej8AWH_Bf09W7xlirvK6l&index=44)
- [https://www.youtube.com/watch?v=LGmvg0m1mJk&list=PLQ3sZ7NCnFIEej8AWH\\_Bf09W7xlirvK6l&index=45](https://www.youtube.com/watch?v=LGmvg0m1mJk&list=PLQ3sZ7NCnFIEej8AWH_Bf09W7xlirvK6l&index=45)

**Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning**

- Visit to any Robot implemented manufacturing/assembly industry
- Demonstration of Robot operations
- Demonstration of working of Robot
- Demonstration of Robot programming applied to a typical robot task
- Video demonstration of latest trends in mobility/robotics
- Contents related activities (Activity-based discussions)
  - For active participation of students, instruct the students to prepare Flowcharts and Handouts
  - Organizing Group wise discussions on issues
  - Seminars

<b>MATLAB FOR MECHANICAL ENGINEERS</b>															
<b>Course Code</b>	<b>22MEE461</b>								<b>CIE Marks</b>	<b>50</b>					
<b>L:T:P:S</b>	<b>0:0:1:0</b>								<b>SEE Marks</b>	<b>50</b>					
<b>Hrs / Week</b>	<b>02</b>								<b>Total Marks</b>	<b>100</b>					
<b>Credits</b>	<b>01</b>								<b>Exam Hours</b>	<b>03</b>					
<b>Course outcomes:</b>															
At the end of the course, the student will be able to:															
22MEE461.1	Analyze Matrices, Differential equations, Integration, System of Linear Equations using MATLAB.														
22MEE461.2	Solve engineering problems using MATlab to develop the proficiency in variational calculus.														
22MEE461.3	Solve Mechanical Engineering problems like Airfoil, Engineering mechanics, Truss, Vibration using MATLAB														
22MEE461.4	Understand the Plots using MATLAB software.														
<b>Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:</b>															
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>	
22MEE461.1	3	3	-	3	2	-	-	-	1	1	-	2	3	-	
22MEE461.2	3	2	-	3	-	-	-	-	1	1	-	2	2	3	
22MEE461.3	3	3	3	3	-	-	-	-	1	1	-	2	3	3	
22MEE461.4	-	-	3	3	3	-	-	-	1	1	-	2	3	-	
<b>Exp. No.</b>	<b>List of Experiments</b>											<b>Hours</b>	<b>COs</b>		
<b>Prerequisite Experiments / Programs / Demo</b>															
	<ul style="list-style-type: none"> <li>Engineering Mathematics</li> </ul>														
<b>PART-A</b>															
1	Introduction to Matlab codes											2	22MEE461.1		
2	Solving Matrices Problems, System of Linear Equations using MATLAB Codes.											2	22MEE461.1		
3	Solving Trigonometric problems using MATLAB Codes.											2	22MEE461.1		
4	Solving Logarithmic Equations using MATLAB Codes.											2	22MEE461.2		
5	Solving Differential Equations using MATLAB Codes.											2	22MEE461.2		
6	Solving Differentiation and Integration Problems Using MATLAB Codes											2	22MEE461.2		
<b>PART-B</b>															
7	Solving Mechanical Engineering Problems - Engineering mechanics ,Truss problems											2	22MEE461.3		
8	Solving Mechanical Engineering problems - Airfoil											2	22MEE461.3		
9	Mechanical Vibration problems- Beats											2	22MEE461.3		
10	Generating Overlay plots using plot command, Hold command, Line commands											2	22MEE461.4		
11	Solving the Bode plots using Mat Lab codes											2	22MEE461.4		
12	Solving the Heat Transfer Problems using Mat Lab codes-Heat conduction problem											2	22MEE461.4		
<b>PART-C</b>															
<ul style="list-style-type: none"> <li><a href="https://www.mathworks.com/videos/virtual-labs-with-matlab-and-simulink-1605544954052.html">https://www.mathworks.com/videos/virtual-labs-with-matlab-and-simulink-1605544954052.html</a></li> <li><a href="https://www.mathworks.com/academia/educators/resources.html">https://www.mathworks.com/academia/educators/resources.html</a></li> </ul>															

**CIE Assessment Pattern (50 Marks - Lab)**

RBT Levels		Test (s)	Weekly Assessment
		20	30
L1	Remember	-	-
L2	Understand	5	5
L3	Apply	5	10
L4	Analyze	5	10
L5	Evaluate	5	5
L6	Create		

**SEE Assessment Pattern (50 Marks - Lab)**

RBT Levels		Exam Marks Distribution (50)
L1	Remember	05
L2	Understand	05
L3	Apply	10
L4	Analyze	20
L5	Evaluate	10
L6	Create	

**Reference Books:**

- 1) Rao V Dukkipatti : Matlab for Mechanical Engineers, New Age Science,2009
- 2) Y kirani singh, B. B\_chaudhuri : Matlab Programming, PHI Learning Edition June 2007
- 3) David Houcque :Introduction to MATLAB for Engineering students, North western University,version 1.2,August 2005

<b>ENERGY MANAGEMENT AND AUDITING</b>														
<b>Course Code</b>	<b>22MEE462</b>					<b>CIE Marks</b>			<b>50</b>					
<b>L:T:P:S</b>	<b>1:0:0:0</b>					<b>SEE Marks</b>			<b>50</b>					
<b>Hrs / Week</b>	<b>01</b>					<b>Total Marks</b>			<b>100</b>					
<b>Credits</b>	<b>01</b>					<b>Exam Hours</b>			<b>03</b>					
<b>Course outcomes:</b>														
At the end of the course, the student will be able to:														
22MEE462.1	Identify the demand supply gap of energy in specific applications at education buildings.													
22MEE462.2	Carry out energy audit of applications in industry / Organization.													
22MEE462.3	Draw the energy flow diagram of an application and identify the energy wasted													
22MEE462.4	Perform energy audit in any type of application and suggest the conservation measures.													
<b>Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:</b>														
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>
22MEE462.1	2	3	-	-	-	-	-	-	2	3	-	-	3	-
22MEE462.2	-	3	3	-	2	2	-	-	-	-	-	-	-	3
22MEE462.3	-	2	-	3	-	-	3	2	-	2	-	-	-	3
22MEE462.4	2	-	-	3	-	3	-	-	2	-	-	-	3	-
<b>MODULE-1 Industrial Energy Conservation 22MEE462.1,3 3 Hours</b>														
Introduction , Initiatives in India, Potential energy Conservation, Barriers, Energy audit and types														
Self-study / Case Study / Applications		Explore the energy Conservation and Energy audit												
Text Book		Text Book 1: 1 to 10												
<b>MODULE-2 Diesel Generating sets 22MEE462.2,3,4 3 Hours</b>														
Introduction, System description, Fuel Conservation, waste heat recovery, fuel additives, Lubricating oil Conservation														
Self-study / Applications		Explore the Diesel Generating sets and applications.												
Text Book		Text Book 1: 217 to 224												
<b>MODULE-3 Cooling Towers 22MEE462.2,3,4 3 Hours</b>														
Introduction, Classification, Selection and usage, Factors affecting cooling tower performance and Energy saving opportunities														
Self-study / Case Study		Energy saving types												
Text Book		Text Book 1: 177 to 185												
<b>MODULE-4 Solar energy options for Industries 22MEE462.2,3,4 3 Hours</b>														
Introduction , Solar Thermal Technologies, Solar Collector, Solar thermal systems and Industrial process heating														
Self-study / Case Study / Applications		Performance test on Solar radiation on various systems.												
Text Book		Text Book 1: 236 to 246												
<b>MODULE-5 Refrigeration and Air conditioning 22MEE462.2,3,4 3 Hours</b>														
Introduction, Types, Comparison between VCR and VAR systems, Measurements and field testing, Performance evaluation and Energy efficiency														

Self-study / Case Study / Applications	Energy analysis of the refrigeration systems.
Text Book	Text Book 1: 127 to 147

**CIE Assessment Pattern (50 Marks - Theory)**

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)	MCQ's
		25	15	10
L1	Remember	5	-	-
L2	Understand	5	5	-
L3	Apply	5	5	5
L4	Analyze	5	5	5
L5	Evaluate	5	-	-
L6	Create	-	-	-

**SEE Assessment Pattern (50 Marks - Theory)**

RBT Levels		Exam Marks Distribution (50)
L1	Remember	5
L2	Understand	10
L3	Apply	15
L4	Analyze	15
L5	Evaluate	5
L6	Create	-

**Suggested Learning Resources:**

**Text Books:**

1) Y P Abbi and Shashank Jain , Hand book on Energy Audit and Environment Management, TERI, New Delhi,2006

**Reference Books:**

1) Trivedi, PR, Jolka KR, Energy Management, Commonwealth Publication, New Delhi, 1997.  
2) Ursula Eicker, "Solar Technologies for buildings", Wiley publications, 2003.

**Web links and Video Lectures (e-Resources):**

- <https://www.youtube.com/watch?v=agSEQaVMkDE>
- <https://courses.ensaveindia.in/courses/general-aspects-of-energy-management-and-energy-audit>
- <https://www.youtube.com/watch?v=yyr2x3KbiKg>

**Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning**

- Visit to any type of Energy Conservation systems
- Demonstration of Energy Conservation systems – Various renewable and non-renewable type
- Video demonstration of latest trends in Energy Conservation systems
- Contents related activities (Activity-based discussions)
  - For active participation of students, instruct the students to prepare Flowcharts and Handouts
  - Seminars

<b>DISASTER MANAGEMENT</b>															
<b>Course Code</b>	22MEE463					<b>CIE Marks</b>					50				
<b>L:T:P:S</b>	1:0:0:0					<b>SEE Marks</b>					50				
<b>Hrs / Week</b>	01					<b>Total Marks</b>					100				
<b>Credits</b>	01					<b>Exam Hours</b>					03				
<b>Course outcomes:</b>															
At the end of the course, the student will be able to:															
22MEE463.1	Understands the basics and classifications of disasters and Hazards.														
22MEE463.2	Describe various types of disasters, hazards and develop disaster response strategies.														
22MEE463.3	Apply the techniques used to assess the damages by disaster.														
22MEE463.4	Analyze the disaster response strategies														
<b>Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:</b>															
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>	
22MEE463.1	3	1	-	-	-	3	3	2	3	3	3	3	-	-	
22MEE463.2	3	2	-	2	2	3	3	3	3	2	2	3	2	1	
22MEE463.3	3	2	-	2	2	3	3	3	2	2	2	3	2	1	
22MEE463.4	3	2	3	3	3	2	1	1	1	2	3	2	1	2	
<b>MODULE-1</b>	<b>FUNDAMENTAL CONCEPTS OF DISASTERS AND HAZARDS</b>										<b>22MEE463.1</b>		<b>3 Hours</b>		
Introduction - Disaster and types of disaster. Natural Disasters: Earthquakes, Volcanoes, Cyclones, Tsunamis, Floods and Landslides. Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Outbreaks Of Disease And Epidemics, War And Conflicts.															
Self-study / Case Study			Endemic, Epidemics and Pandemics.												
Text Book			Text Book 1: Chapter 3.1, 3.2, 3.5, 3.6												
<b>MODULE-2</b>	<b>DISASTER RESPONSE STRATEGIES.</b>										<b>22MEE463.2</b>		<b>3 Hours</b>		
Disaster Management Cycle, Phases of Disaster, Preparedness Plans, Action Plans and Procedures, Early warning Systems Models in disaster preparedness, Components of Disaster Relief- (Water, food, sanitation, shelter, Health and Waste Management), Community based DRR															
Self-study / Case Study			Concept of life period based design- case study												
Text Book			Text Book 1: Chapter 2.2, 2.5 , 2.6												
<b>MODULE-3</b>	<b>TECHNIQUES OF DAMAGE ASSESSMENT</b>										<b>22MEE463.4</b>		<b>3 Hours</b>		
New & emerging approaches in disaster management – Use of information technology (GIS, GPS etc) in disaster management – Community based disaster preparedness – Disaster risk reduction – Safety audits, onsite and offsite emergency plans -Management of transportation accidents.															
Text Book			Text Book 2: Chapter 4.1, 4.3,4.4, 4.5												
<b>MODULE-4</b>	<b>RESTORATION, RECONSTRUCTION AND RECOVERY COMMUNITY STRUCTURES</b>										<b>22MEE463.5</b>		<b>3 Hours</b>		
Safety analysis and rating – reliability assessment repairs and retrofitting techniques of community structures – dams and bridges, Testing and evaluation - methods and materials for strengthening for different disaster qualification test, detailing aspects of structures subjected to probable disaster - analysis methodology – techniques for optimal performance, provision for artificial disaster – blast and impact, developing disaster resistant buildings.															

Self-Learning Exercise	Construction techniques, Protection buildings.			
Text Book	Text Book 3 : Chapter 8.1,8.2, 8.3			
<b>MODULE-5</b>	<b>HAZARD AND VULNERABILITY PROFILE INDIA</b>	<b>22MEE463.6</b>	<b>3 Hours</b>	
Disaster Management Indian scenario, Disaster Management Act 2005, Dam Safety Act and Policy guidelines, National Institute of Disaster Management, National Disaster Response Force (NDRF), National Disaster Management Authority, States Disaster Management Authority, District Disaster Management Authority.				
Self-Learning Exercise	Disaster profile Case Studies of India			
Text Book	Text Book 3: Chapter 10.11, 10.12, 10.13			
<b>CIE Assessment Pattern (50 Marks - Theory) -</b>				
<b>RBT Levels</b>		<b>Marks Distribution</b>		
		<b>Test (s)</b>	<b>Qualitative Assessment (s)</b>	<b>MCQ's</b>
		<b>25</b>	<b>15</b>	<b>10</b>
<b>L1</b>	<b>Remember</b>	5	5	-
<b>L2</b>	<b>Understand</b>	5	5	-
<b>L3</b>	<b>Apply</b>	5	5	5
<b>L4</b>	<b>Analyze</b>	5		5
<b>L5</b>	<b>Evaluate</b>	5		-
<b>L6</b>	<b>Create</b>	-		-
<b>SEE Assessment Pattern (50 Marks - Theory)</b>				
<b>RBT Levels</b>		<b>Exam Marks Distribution (50)</b>		
<b>L1</b>	<b>Remember</b>	<b>10</b>		
<b>L2</b>	<b>Understand</b>	<b>10</b>		
<b>L3</b>	<b>Apply</b>	<b>10</b>		
<b>L4</b>	<b>Analyze</b>	<b>10</b>		
<b>L5</b>	<b>Evaluate</b>	<b>10</b>		
<b>L6</b>	<b>Create</b>	<b>--</b>		
<b>Suggested Learning Resources:</b>				
<b>Text Books:</b>				
1. Dr. Mrinalini Pandey, "Disaster Management", Wiley India Pvt. Ltd.				
2. Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill Education (India) Pvt. Ltd.				
3. Jagbir Singh, "Disaster Management: Future Challenges and Opportunities", K W Publishers Pvt. Ltd.				
<b>Reference Books:</b>				
1. Raiker, R.N., "Learning from Failures, Deficiencies in Design, Construction and Service", R & D Centre, Raiker Bhavan, 1987.				
2. R.B. Singh., "Natural Hazard and disaster management- vulnerability and mitigation".J. P. Singhal, "Disaster Management", Laxmi Publications.				
<b>Web links and Video Lectures (e-Resources):</b>				
<ul style="list-style-type: none"> <li>• <a href="https://onlinecourses.nptel.ac.in/noc22_ge24/preview">https://onlinecourses.nptel.ac.in/noc22_ge24/preview</a></li> <li>• <a href="https://disastermanagement.berkeley.edu/disaster-managemenet-course/">https://disastermanagement.berkeley.edu/disaster-managemenet-course/</a></li> <li>• <a href="https://www.youtube.com/watch?v=cwxXY9Qe8ss">https://www.youtube.com/watch?v=cwxXY9Qe8ss</a></li> <li>• <a href="https://www.youtube.com/watch?v=V2GvQXvjhLA">https://www.youtube.com/watch?v=V2GvQXvjhLA</a></li> <li>• <a href="https://ndrf-gov-resources.ndrf.gov/2023-03/Bio-inspired%20Design%20Workshop%20Report%202232327%20October%202022%20Final.508.pdf">https://ndrf-gov-resources.ndrf.gov/2023-03/Bio-inspired%20Design%20Workshop%20Report%202232327%20October%202022%20Final.508.pdf</a></li> </ul>				



**Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning**

- Visit to any emergency fire station in the institute and conduct a fire drill.
- Demonstration of disaster management by taking any real time examples
- Demonstration of implementation of disaster response strategies by taking any practical examples.
- Demonstration of application of damage assessment techniques
- Motivational videos from survivals.
- Contents related activities (Activity-based discussions)
  - For active participation of students, instruct the students to prepare Flowcharts and Handouts
  - Organizing Group wise discussions on issues
  - Seminars

<b>AIR POLLUTION CONTROL</b>														
<b>Course Code</b>	<b>22MEE464</b>					<b>CIE Marks</b>	<b>50</b>							
<b>L:T:P:S</b>	<b>1:0:0:0</b>					<b>SEE Marks</b>	<b>50</b>							
<b>Hrs / Week</b>	<b>01</b>					<b>Total Marks</b>	<b>100</b>							
<b>Credits</b>	<b>01</b>					<b>Exam Hours</b>	<b>03</b>							
<b>Course outcomes:</b>														
At the end of the course, the student will be able to:														
22MEE464.1	Identify the major sources of air pollution and understand their effects on health and environment.													
22MEE464.2	Understand the major meteorological factors affecting air pollution													
22MEE464.3	Analyze control techniques for particulate and gaseous emissions													
22MEE464.4	Understand NO <sub>x</sub> and SO <sub>x</sub> control technologies and control of motor vehicle emission													
<b>Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:</b>														
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PS01</b>	<b>PS02</b>
22MEE464.1	3	3	-	-	-	-	2	-	-	-	-	2	-	2
22MEE464.2	3	2	-	-	-	-	-	-	-	-	-	2	-	2
22MEE464.3	3	3	-	-	-	-	2	-	-	-	-	2	2	3
22MEE464.4	3	2	-	-	-	-	2	-	-	-	-	2	2	3
<b>MODULE-1 INTRODUCTION AND SOURCES OF AIR POLLUTION</b>														
<b>22MEE464.1 3 Hours</b>														
Structure and composition of atmosphere, sources and classifications of air pollutants and their effect on human health, vegetation, animals, materials, effects of air pollutants on the atmosphere, impacts on precipitation, global effects of air pollution, acid rain, ozone layer and depletion, photochemical smog,														
Self-study / Case Study / Applications Self study on the major pollutants from important industries														
Text Book Text Book 1: 1 to 4 Text Book 2: 2.1 to 2.2														
<b>MODULE-2 METEOROLOGY</b>														
<b>22MEE464.2 3 Hours</b>														
Introduction, meteorology and climatology, major meteorological factors affecting air pollution, scales of meteorology, metrological parameter, rainfall and precipitation, maximum mixing depth, plume behavior, single stack and multiple source pollution														
Self-study / Case Study / Applications Case study on effect of pollution on rainfall														
Text Book Text Book 1: 6 Text Book 2: 3.1 to 3.5														
<b>MODULE-3 Control of Particulate Pollutants and Gaseous Pollutants</b>														
<b>22MEE464.3 3 Hours</b>														
Particulate pollutants control technology: Particle characteristics, control of particles by filters, control of particulates by electrostatic precipitation, control of particles by mechanical collectors.														
Control of gaseous pollutants: introduction, physical properties and occurrence of Sulphur compounds, nitrogen compounds, carbon compounds, hazardous air pollutants, Control of gases by absorption, adsorption and condensation														
Self-study / Case Study / Applications Case study on the type of particulate filter														
Text Book Text Book 1: 7 and 8														
<b>MODULE-4 NO<sub>x</sub> AND SO<sub>x</sub> CONTROL TECHNOLOGY</b>														
<b>22MEE464.4 3 Hours</b>														

Control of NO <sub>x</sub> : Sources of nitrogen oxides, formation of NO and NO <sub>2</sub> , factors affecting NO <sub>x</sub> formation, NO <sub>x</sub> control Methods, Recent development in NO <sub>x</sub> control				
Control of Sox: Introduction, H <sub>2</sub> S control, SO <sub>2</sub> removal, dry methods, SO <sub>3</sub> and sulphuric acid				
Self-study / Case Study / Applications		Case studies on recent developments in NO <sub>x</sub> control techniques		
Text Book		Text Book 2: 10.1, 10.3, 10.5, 10.7		
<b>MODULE-5</b>		<b>CONTROL OF MOTOR VEHICLE EMISSIONS</b>	<b>22MEE464.4</b> <b>3 Hours</b>	
Introduction, Motor vehicle engines, automotive fuels-gasoline, alternative fuels and alcohol fuels, low emission and zero emission vehicles, diesel exhaust particles and its health effects, emission control technologies.				
Self-study/ Case Study / Applications		Case studies of petrol and diesel emission test		
Text Book		Text Book 1: 14		
<b>CIE Assessment Pattern (50 Marks - Theory)</b>				
<b>RBT Levels</b>		<b>Marks Distribution</b>		
		<b>Test (s)</b>	<b>Qualitative Assessment (s)</b>	<b>MCQ's</b>
		<b>25</b>	<b>15</b>	<b>10</b>
<b>L1</b>	<b>Remember</b>	5	-	-
<b>L2</b>	<b>Understand</b>	5	5	
<b>L3</b>	<b>Apply</b>	5	5	5
<b>L4</b>	<b>Analyze</b>	5	5	5
<b>L5</b>	<b>Evaluate</b>	5	-	-
<b>L6</b>	<b>Create</b>	-	-	-
<b>SEE Assessment Pattern (50 Marks - Theory)</b>				
<b>RBT Levels</b>		<b>Exam Marks Distribution (50)</b>		
<b>L1</b>	<b>Remember</b>	<b>10</b>		
<b>L2</b>	<b>Understand</b>	<b>20</b>		
<b>L3</b>	<b>Apply</b>	<b>10</b>		
<b>L4</b>	<b>Analyze</b>	<b>10</b>		
<b>L5</b>	<b>Evaluate</b>	<b>--</b>		
<b>L6</b>	<b>Create</b>	<b>--</b>		
<b>Suggested Learning Resources:</b>				
<b>Text Books:</b>				
1) Textbook of Air pollution and its control, S.C Bhatia, Atlantic Publishers and distributors (p) ltd., 2007				
2) Air Pollution, M N Rao, H V N Rao, McGraw Hill Education (India) Private ltd., 2013				
3) Air Pollution and control Technologies, Anjaneyulu, Allied Publishers (P) Ltd., India, 2002				
<b>Reference Books:</b>				
1) Sewage Disposal and Air Pollution Engineering, Santosh Kumar Garg, Khanna Publishers, 2012.				
2) Environmental Pollution Control Engineering, C S Rao, New Age International (P) limited Publishers, 2006.				
3) Air pollution, David H F Liu, Bela G Liptak, Lweis Publishers, 2000				

**Web links and Video Lectures (e-Resources):**

- [https://onlinecourses.nptel.ac.in/noc23\\_ce14/preview](https://onlinecourses.nptel.ac.in/noc23_ce14/preview)
- <https://nptel.ac.in/courses/105102089>
- <https://nptel.ac.in/courses/105104099>

**Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning**

- Video demonstration of latest trends in air pollution control
- Contents related activities (Activity-based discussions)
  - For active participation of students, instruct the students to prepare Flowcharts and Handouts
  - Organizing Group wise discussions on issues
  - Seminars

### NATIONAL SERVICE SCHEME (NSS)

<b>Course Code</b>	<b>22NSS40</b>	<b>CIE Marks (each Semester)</b>	<b>50</b>
<b>L:T:P:S</b>	<b>0:0:0:0</b>	<b>SEE Marks</b>	<b>--</b>
<b>Hrs / Week</b>	<b>02</b>	<b>Total Marks</b>	<b>50 x 4 = 200</b>
<b>Credits</b>	<b>00</b>	<b>Exam Hours</b>	<b>02</b>

**Course outcomes:**

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

22NSS40.1	Understand the importance of his / her responsibilities towards society.
22NSS40.2	Analyse the environmental and societal problems/issues and will be able to design solutions for the same.
22NSS40.3	Evaluate the existing system and to propose practical solutions for the same for sustainable development. Implement government or self-driven projects effectively in the field.
22NSS40.4	Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.

**Mapping of Course Outcomes to Program Outcomes:**

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
22NSS40.1	-	-	-	-	-	3	-	-	2	-	-	1
22NSS40.2	-	-	-	-	-	3	3	-	2	-	-	1
22NSS40.3	-	-	-	-	-	3	3	-	2	-	-	1
22NSS40.4	-	-	-	-	-	3	3	-	2	-	-	1

<b>Semester/ Course Code</b>	<b>CONTENT</b>	<b>COs</b>	<b>HOURS</b>
<b>4<sup>TH</sup> 22NSS40</b>	4. Water conservation techniques - Role of different stakeholders- Implementation. 5. Preparing an actionable business proposal for enhancing the village income and approach for implementation. 6. Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.	22NSS40.1, 22NSS40.2, 22NSS40.3, 22NSS40.4	30 HRS

**CIE Assessment Pattern (50 Marks - Activity based) -**

<b>CIE component for every semester</b>	<b>Marks</b>
Presentation - 1 Selection of topic, PHASE - 1	10
Commencement of activity and its progress - PHASE - 2	10
Case study-based Assessment Individual performance	10
Sector wise study and its consolidation	10
Video based seminar for 10 minutes by each student at the end of semester with Report.	10
<b>Total marks for the course in each semester</b>	<b>50</b>

- Implementation strategies of the project (NSS work).
- The last report should be signed by NSS Officer, the HOD and principal.
- At last report should be evaluated by the NSS officer of the institute.

- Finally, the consolidated marks sheet should be sent to the university and also to be made available at LIC visit.

**Suggested Learning Resources:**

**Reference Books:**

13. NSS Course Manual, Published by NSS Cell, VTU Belagavi.
14. Government of Karnataka, NSS cell, activities reports and its manual.
15. Government of India, NSS cell, Activities reports and its manual.

**Pre-requisites to take this Course:**

4. Students should have a service-oriented mindset and social concern.
5. Students should have dedication to work at any remote place, anytime with available resources and proper time management for the other works.
6. Students should be ready to sacrifice some of the time and wishes to achieve service-oriented targets on time.

**Pedagogy:**

- In every semester from 3rd semester to 6th semester, each student should do activities according to the scheme and syllabus.
- At the end of every semester student performance has to be evaluated by the NSS officer for the assigned activity progress and its completion.
- At last, in 6th semester consolidated report of all activities from 3rd to 6th semester, compiled report should be submitted as per the instructions.
- State the need for NSS activities and its present relevance in the society and provide real-life examples.
- Support and guide the students for self-planned activities.
- NSS coordinator will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress in real activities in the field.
- Encourage the students for group work to improve their creative and analytical skills.

**Plan of Action:**

- Student/s in individual or in a group Should select any one activity in the beginning of each semester till end of that respective semester for successful completion as per the instructions of NSS officer with the consent of HOD of the department.
- At the end of every semester, activity report should be submitted for evaluation.
- Practice Session Description:
  - Lecture session by NSS Officer
  - Students Presentation on Topics
  - Presentation - 1, Selection of topic, PHASE - 1
  - Commencement of activity and its progress - PHASE - 2
  - Execution of Activity
  - Case study-based Assessment, Individual performance
  - Sector/ Team wise study and its consolidation
  - Video based seminar for 10 minutes by each student at the end of semester with Report.

Sl No	Topic	Groupsize	Location	Activity execution	Reporting	Evaluation of the Topic
1.	Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.	May be individual or team	Farmers land/Villages/ roadside / Community area / College campus	Site selection /proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
2.	Waste management- Public, Private and Govt organization, 5 R's.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers/ campus	Site selection /proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
3.	Setting of the information imparting club for women leading to contribution in social and economic issues.	May be individual or team	Women empowerment groups/ Consulting NGOs & Govt Teams / College campus	Group selection/ proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
4.	Water conservation techniques – Role of different stakeholders– Implementation.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers/ campus	site selection / proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer

5.	Preparing an actionable business proposal for enhancing the village income and approach for implementation.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers/ campus	Group selection/ proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
6.	Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.	May be individual or team	Local government / private/ aided schools/ Government Schemes officers	School selection/ proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
7.	Developing Sustainable Water management system for rural areas and implementation approaches.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers/ campus	site selection/ proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
8.	Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers/ campus	Group selection/ proper consultation/ Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer



9.	Spreading public awareness under rural outreach programs. (minimum 5 programs)	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers/ campus	Group selection/ proper consultation/ Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
10.	Organize National integration and social harmony events / workshops / seminars. (Minimum 02 programs).	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers/ campus	Place selection/ proper consultation/ Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
11.	Govt. school Rejuvenation and helping them to achieve good infrastructure.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers/ campus	Place selection/ proper consultation/ Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer

<b>PHYSICAL EDUCATION (PE) (SPORTS AND ATHLETICS)</b>												
<b>Course Code</b>	<b>22PED40</b>						<b>CIE Marks (each semester)</b>			<b>50</b>		
<b>L:T:P:S</b>	<b>0:0:0:0</b>						<b>SEE Marks</b>			<b>--</b>		
<b>Hrs / Week</b>	<b>02</b>						<b>Total Marks</b>			<b>50 x 2= 100</b>		
<b>Credits</b>	<b>00</b>						<b>Exam Hours</b>			<b>02</b>		
<b>Course outcomes:</b>												
At the end of the course, the student will be able to:												
22PED40.1	Understand the fundamental concepts and skills of Physical Education, Health, Nutrition and Fitness											
22PED40.2	Create consciousness among the students on Health, Fitness and Wellness in developing and maintaining a healthy lifestyle											
22PED40.3	Perform in the selected sports or athletics of student's choice and participate in the competition at regional/state / national / international levels.											
22PED40.4	Understand the roles and responsibilities of organization and administration of sports and games											
<b>Mapping of Course Outcomes to Program Outcomes:</b>												
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>
22PED40.1	-	-	-	-	-	2	-	3	3	-	-	2
22PED40.2	-	-	-	-	-	2	-	3	3	-	-	2
22PED40.3	-	-	-	-	-	2	-	3	3	-	-	2
22PED40.4	-	-	-	-	-	2	-	3	3	-	-	2
<b>Semester</b>	<b>CONTENT</b>								<b>COs</b>		<b>HOURS</b>	
<b>22PED40</b>	<b>Module 1: Ethics and Moral Values</b> A. Ethics in Sports B. Moral Values in Sports and Games								22PED40.1, 22PED40.2		5 HRS	
	<b>Module 2: Specific Games (Anyone to be selected by the student)</b> A. Volleyball – Attack, Block, Service, Upper Hand Pass and Lower hand Pass. B. Throwball – Service, Receive, Spin attack, Net Drop & Jump throw. C. Kabaddi – Hand touch, Toe Touch, Thigh Hold, Ankle hold and Bonus. D. Kho-Kho – Giving Kho, Single Chain, Pole dive, Pole turning, 3-6 Up. E. Table Tennis – Service (Fore Hand & Back Hand), Receive (Fore Hand & Back Hand), Smash. F. Athletics (Track / Field Events) – Any event as per availability of Ground.								22PED40.3		20 HRS	
	<b>Module 3: Role of Organization and administration</b>								22PED40.4		5 HRS	
<b>CIE Assessment Pattern (50 Marks – Practical) –</b>												
CIE to be evaluated every semester end based on practical demonstration of Sports and Athletics activities learnt in the semester.												
<b>CIE</b>						<b>Marks</b>						
Participation of student in all the modules						10						

	Quizzes – 2, each of 7.5 marks	15	
	Final presentation / exhibition / Participation in competitions/ practical on specific tasks assigned to the students	25	
	<b>Total</b>	<b>50</b>	

**Suggested Learning Resources:**

**Reference Books:**

12. Saha, A.K. Sarir Siksher Ritiniti, Rana Publishing House, Kalyani.
13. Bandopadhyay, K. Sarir Siksha Parichay, Classic Publishers, Kolkata.
14. Petipus, et.al., Athlete’s Guide to Career Planning, Human Kinetics.
15. Dharma, P.N. Fundamentals of Track and Field, Khel Sahitya Kendra, New Delhi.
16. Jain, R. Play and Learn Cricket, Khel Sahitya Kendra, New Delhi.
17. Vivek Thani, Coaching Cricket, Khel Sahitya Kendra, New Delhi.
18. Saha, A.K. Sarir Siksher Ritiniti, Rana Publishing House, Kalyani.
19. Bandopadhyay, K. Sarir Siksha Parichay, Classic Publishers, Kolkata
20. Naveen Jain, Play and Learn Basketball, Khel Sahitya Kendra, New Delhi.
21. Dubey H.C., Basketball, Discovery Publishing House, New Delhi.
22. Rachana Jain, Teach Yourself Basketball, Sports Publication.
15. Jack Nagle, Power Pattern Offences for Winning basketball, Parker Publishing Co., New York.
16. Renu Jain, Play and Learn Basketball, Khel Sahitya Kendra, New Delhi.
17. SallyKus, Coaching Volleyball Successfully, Human Kinetics.

YOGA												
Course Code	22YOG40						CIE Marks (each Semester)	50				
L:T:P:S	0:0:0:0						SEE Marks	--				
Hrs / Week	02						Total Marks	50 x 4 = 200				
Credits	00						Exam Hours	02				
<b>Course outcomes:</b>												
At the end of the course, the student will be able to:												
22YOG40.1	Use Yogasana practices in an effective manner											
22YOG40.2	Become familiar with an authentic foundation of Yogic practices											
22YOG40.3	Practice different Yogic methods such as Suryanamaskara, Pranayama and some of the Shat Kriyas											
22YOG40.4	Use the teachings of Patanjali in daily life.											
<b>Mapping of Course Outcomes to Program Outcomes:</b>												
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
22YOG40.1	-	-	-	-	-	3	-	-	-	-	-	1
22YOG40.2	-	-	-	-	-	3	-	-	-	-	-	1
22YOG40.3	-	-	-	-	-	3	-	-	-	-	-	1
22YOG40.4	-	-	-	-	-	3	-	-	-	-	-	1
<b>Semester / Course Code</b>												
<b>CONTENT</b>												
<b>COs</b>												
<b>HOURS</b>												
<b>4<sup>TH</sup> 22YOG40</b>	<b>Suryanamaskara:</b> Suryanamaskar 12 count,4rounds											
	<b>Brief introduction and importance of: Kapalabhati:</b> Revision of Kapalabhati -40strokes/min3rounds <b>Different types of Asanas:</b> 1. Sitting: Paschimottanasana, Ardha Ushtrasana, Vakrasana, Aakarna Dhanurasana 2. Standing: Parshva Chakrasana, Urdhva Hastothanasana, Hastapadasana 3. Prone line: Dhanurasana 4. Supine line: Karna Peedasana, Sarvangasana, Chakraasana <b>Patanjali's Ashtanga Yoga:</b> Asana, Pranayama <b>Pranayama:</b> Chandra Bhedana, Nadishodhana, Surya Bhedana											
22YOG40.1, 22YOG40.2, 22YOG40.3, 22YOG40.4												
Total 32 Hrs/ Semester 2 Hrs/week												
<b>CIE Assessment Pattern (50 Marks - Practical) -</b>												
CIE to be evaluated every semester based on practical demonstration of Yogasana learnt in the semester and internal tests (objective type)												
<b>CIE</b>						<b>Marks</b>						
Avg of Test 1 and Test 2						25						
Demonstration of Yogasana						25						
<b>Total</b>						<b>50</b>						

**Suggested Learning Resources:****Reference Books:**

16. Swami Kuvulyananda: Asma (Kavalyadhama, Lonavala)
17. Tiwari, O P: Asana Why and How
18. Ajitkumar: Yoga Pravesha (Kannada)
19. Swami Satyananda Saraswati: Asana Pranayama, Mudra, Bandha (Bihar School of yoga, Munger)
20. Swami Satyananda Saraswati: Surya Namaskar (Bihar School of yoga, Munger)
21. Nagendra H R: The art and science of Pranayama
22. Tiruka: Shatkriyegalu (Kannada)
23. Iyengar B K S: Yoga Pradipika (Kannada)
24. Iyengar B K S: Light on Yoga (English)

**Web links and Video Lectures (e-Resources):**

- <https://youtu.be/KB-TYlgd1wE>
- <https://youtu.be/aa-TG0Wg1Ls>

<b>UNIVERSAL HUMAN VALUES AND LIFE SKILLS</b>												
<b>Course Code</b>	<b>22UHK47</b>						<b>CIE Marks</b>			<b>50</b>		
<b>L:T:P:S</b>	<b>1:0:0:0</b>						<b>SEE Marks</b>			<b>50</b>		
<b>Hrs / Week</b>	<b>02</b>						<b>Total Marks</b>			<b>100</b>		
<b>Credits</b>	<b>01</b>						<b>Exam Hours</b>			<b>02</b>		
<b>Course outcomes:</b>												
At the end of the course, the student will be able to:												
22UHK47.1	Understand the concept and significance of life skills and universal human values.											
22UHK47.2	Develop Self-awareness and Self-management skills to promote personal growth.											
22UHK47.3	Apply Critical and Creative thinking and ethical decision-making skills in various contexts.											
22UHK47.4	Promote teamwork and collaboration while respecting diversity and inclusivity.											
<b>Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:</b>												
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>
22UHK47.1	-	-	-	-	-	3	1	3	-	2	-	2
22UHK47.2	-	-	-	-	-	1	2	1	-	2	-	2
22UHK47.3	-	-	-	-	-	3	1	3	1	2	-	2
22UHK47.4	-	-	-	-	-	2	2	1	3	3	-	3
<b>MODULE-1</b>	<b>Self-Awareness and Self-Management</b>						<b>22UHK47.1</b> <b>22UHK47.2</b>			<b>3 Hours</b>		
Emotional Intelligence, Techniques of self-awareness: SWOT and JOHARI WINDOWS, Stress management and coming out of comfort zone, managing failure, Time Management to recalibrate priorities. Self-Exploration as a process of Value Education, the basic human Aspirations: Prosperity and Happiness, understanding infatuation.												
Self-study / Role play			Understand qualities of Role Models, explore self and do SWOT analysis for growth; participate in role play and presentations to come out of comfort zone									
<b>MODULE-2</b>	<b>Towards Yourself</b>						<b>22UHK47.1</b> <b>22UHK47.3</b>			<b>3 Hours</b>		
Exploring opportunities, understanding expectations and self for right fitment in profession, Goal Setting - Personal and Professional, aligning Personal and Professional goals for greater achievement, Mind-Maps as a tool for Goal Setting												
Self-study / Mind Maps		Understand industry expectations to set professional goals; realizing connection between personal and professional goals for peaceful living										
<b>MODULE-3</b>	<b>Leading self to lead others</b>						<b>22UHK47.3</b> <b>22UHK47.4</b>			<b>3 Hours</b>		
Quality analysis of leader and self-evaluation, Critical thinking, Creative thinking and Ethical decision making, Critical thinking and Creative thinking for contribution to technical world, Six thinking hats, Exploring ethical decision-making frameworks and principles.												
Activities / Case study/Applications		Case studies for Critical thinking and activities for Creative thinking										
<b>MODULE-4</b>	<b>Ownership towards Family and Society</b>						<b>22UHK47.2</b> <b>22UHK47.3</b> <b>22UHK47.4</b>			<b>3 Hours</b>		

Responsibility, Diversity and Inclusivity: Understanding personal and social responsibility; Appreciating diversity and managing inclusivity, promoting teamwork and collaboration while respecting differences.			
Self-study / Interview with corporate people	Working on Task bar; team building activities; Interviewing Corporate experts to understand expectations		
<b>MODULE-5</b>	<b>Towards Nature and Industry</b>	<b>22UHK47.3</b> <b>22UHK47.4</b>	<b>3 Hours</b>
Personal code of conduct for harmony between self and nature, resisting external pressures, negotiation and conflict resolution, assertiveness and empathy, change management			
Role play	Role play to understand contributions to nature and industry		
<b>CIE Assessment Pattern (50 Marks - Theory) -</b>			
<b>RBT Levels</b>		<b>Marks Distribution</b>	
		<b>Test (s)</b>	<b>Alternative Assessment (s)</b>
		<b>25</b>	<b>25</b>
<b>L1</b>	<b>Remember</b>	-	-
<b>L2</b>	<b>Understand</b>	<b>7</b>	<b>6</b>
<b>L3</b>	<b>Apply</b>	<b>8</b>	<b>7</b>
<b>L4</b>	<b>Analyze</b>	<b>10</b>	<b>7</b>
<b>L5</b>	<b>Evaluate</b>	-	<b>5</b>
<b>L6</b>	<b>Create</b>	-	-
<b>SEE Assessment Pattern (50 Marks - Group Discussion)</b>			
<b>RBT Levels</b>		<b>Exam Marks Distribution (50)</b>	
<b>L1</b>	<b>Remember</b>	<b>10</b>	
<b>L2</b>	<b>Understand</b>	<b>10</b>	
<b>L3</b>	<b>Apply</b>	<b>20</b>	
<b>L4</b>	<b>Analyze</b>	<b>10</b>	
<b>L5</b>	<b>Evaluate</b>	--	
<b>L6</b>	<b>Create</b>	--	
<b>Suggested Learning Resources:</b>			
<b>REFERENCE BOOKS:</b>			
<ol style="list-style-type: none"> <li>1. The 7 Habits of Highly Effective People, Stephen R Covey, Neha publishers.</li> <li>2. Seven Habits of Highly Effective Teens, Convey Sean, New York, Fireside Publishers, 1998.</li> <li>3. Emotional Intelligence, Daniel Coleman, Bantam Book, 2006.</li> <li>4. How to win friends and influence people, Dale Carnegie.</li> <li>5. BHAGAVADGITA for college students, Sandeepa Guntreddy.</li> </ol>			
<b>Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning</b>			
<ul style="list-style-type: none"> <li>• Conduct interviews with HR personnel of corporates to understand expectations in terms of Soft Skills and Values</li> <li>• Participate in role plays and presentations to come out of comfort zone</li> <li>• Talk to industry people to understand opportunities available</li> <li>• Make a short movie to display creativity</li> <li>• Use Mind maps to plan successful completion of semester</li> <li>• Actively participate in Group Discussions and JAM sessions</li> </ul>			

## MINI PROJECT

<b>Course Code</b>	<b>22MEE48</b>	<b>CIE Marks</b>	<b>50</b>
<b>L: T:P:S</b>	<b>0:0:1:0</b>	<b>SEE Marks</b>	<b>50</b>
<b>Hrs / Week</b>	<b>02</b>	<b>Total Marks</b>	<b>100</b>
<b>Credits</b>	<b>01</b>	<b>Exam Hours</b>	<b>03</b>

**Course outcomes:**

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

<b>22MEE48.1</b>	Identify an open ended problem in area of mechanical engineering which requires further investigation.
<b>22MEE48.2</b>	Identify the methods and materials required for the project work
<b>22MEE48.3</b>	Apply the theoretical concepts to solve industrial problems with teamwork and multidisciplinary approach.
<b>22MEE48.4</b>	Formulate and implement innovative ideas for social and environmental benefit

### Mini Project Roadmap: Guiding Principles for Mini Project Success

**Project Overview:**

- Clearly define the project's scope, objectives, and expected outcomes.
- Provide a brief description of the problem the project aims to solve or the functionality it should implement.

**Project Milestones:**

- Set clear project milestones and deadlines for various phases, such as planning, design, implementation, testing, and presentation.

**Project Requirements:**

- List the specific features or functionality that students need to implement in their projects.
- Clearly state any constraints or limitations they should be aware of during development.

**Testing and Quality Assurance:**

- Incorporate testing practices into their development process.
- Specify the types of testing (e.g., unit testing, integration testing)

**Collaboration and Communication:**

- If the project involves teamwork, outline expectations for collaboration, including communication channels and responsibilities within the team.

**Documentation:**

- Emphasize the importance of thorough documentation throughout the project.
- Require students to maintain documentation for code, design, and usage instructions.

**Presentation:**

- Require students to present their projects to the class, explaining their design choices, challenges faced, and how they overcame them.

Text Book | Text Book 1 & 2

**CIE Assessment Pattern (50 Marks – Reviews as per the rubric statements defined)**

RBT Levels		Exam Marks Distribution (50)
<b>L1</b>	<b>Remember</b>	-
<b>L2</b>	<b>Understand</b>	-
<b>L3</b>	<b>Apply</b>	20
<b>L4</b>	<b>Analyze</b>	10
<b>L5</b>	<b>Evaluate</b>	10
<b>L6</b>	<b>Create</b>	10



SEE Assessment Pattern (50 Marks - Theory)		
RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	-
L3	Apply	20
L4	Analyze	10
L5	Evaluate	10
L6	Create	10

**Suggested Learning Resources:**

**Text Books:**

- 1) Kothari, C.R., 2018. Research Methodology: Methods and Techniques. New Age International. ISBN-13: 978-8122436235
- 2) Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2015, An introduction to Research Methodology, RBSA Publishers. ISBN-13: 978-8176111652
- 3) Ranjithkumar, 2014, research methodology, saga publications, 4th edition ISBN-13- 978- 9351501336

**Reference Books:**

- 1).Anderson, T. W., 2011, An Introduction to Multivariate Statistical Analysis, Wiley Eastern Pvt., Ltd., New Delhi. ISBN-13: 978-8126524488
- 2) Montgomery, Douglas C. & Runger, George C. (2016) 6/e, Applied Statistics & probability for Engineers (Wiley India) ISBN-13: 978-1118539712

**Web links and Video Lectures (e-Resources):**

1. <https://www.youtube.com/watch?v=YScxVF6ZcYI>
2. <https://www.youtube.com/watch?v=9WMgaulAJ-0>

**Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning**

These challenging mini project activities can provide students with opportunities to think critically, apply their knowledge, and develop problem-solving skills in a practical context.

**Interdisciplinary Projects:**

- Encourage collaboration among students from different disciplines to work on projects that require diverse expertise.

**Prototype Development:**

- Challenge students to create a prototype of a product or device.

**Simulation and Modelling:**

- Task students with creating computer simulations or mathematical models to solve complex problems or simulate real-world scenarios.

**Humanitarian and Social Impact Projects:**

- Challenge students to develop projects that address social or humanitarian issues, such as providing clean water solutions, designing low-cost healthcare devices, or improving education in underserved communities.

**Environmental Sustainability Projects:**

- Challenge students to propose and implement sustainability initiatives or renewable energy projects.

**Scientific Research Projects:**

- Assign students to conduct scientific research experiments, gather data, and present findings.

<b>BASIC APPLIED MATHEMATICS-II</b>													
<b>Course Code</b>	22DMAT41						<b>CIE Marks</b>				<b>50</b>		
<b>L:T:P:S</b>	0:0:0:0						<b>SEE Marks</b>				--		
<b>Hrs. / Week</b>	2						<b>Total Marks</b>				<b>50</b>		
<b>Credits</b>	00						<b>Exam Hours</b>				--		
<b>Course outcomes:</b>													
At the end of the course, the student will be able to:													
22DMAT41.1	Gain knowledge of basic operations of vectors												
22DMAT41.2	Use curl and divergence of a vector function in three dimensions												
22DMAT41.3	Develop the ability to solve higher order Linear differential equations												
22DMAT41.4	Know the basic concepts of Laplace transform to solve the Periodic functions and also solve initial and boundary value problems using Laplace transform method.												
<b>Mapping of Course Outcomes to Program Outcomes:</b>													
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	
22DMAT41.1	3	3	-	-	-	-	-	-	-	-	-	-	
22DMAT41.2	3	3	-	-	-	-	-	-	-	-	-	-	
22DMAT41.3	3	3	-	-	-	-	-	-	-	-	-	-	
22DMAT41.4	3	3	-	-	-	-	-	-	-	-	-	-	
<b>MODULE-1</b>											<b>VECTORS</b>	<b>22DMAT41.1</b>	<b>8 Hours</b>
Definition of scalar and vector, Vector addition, Subtraction and Multiplication-Dot product, Cross product, Scalar triple product. Orthogonal, Co-planar and Angle between vectors-Problems.													
Text Book	Text Book 1: 3.1, 3.5, 3.6, 3.9, Text Book 2: 7.1, 9.2, 9.3, 9.4.												
<b>MODULE-2</b>											<b>VECTOR DIFFERENTIATION</b>	<b>22DMAT41.2</b>	<b>8 Hours</b>
Vector differential operator-Gradient of a scalar function, Divergence of a vector function, Curl of a vector function-Problems. Solenoidal and irrotational vector fields-Problems.													
Text Book	Text Book 1: 8.5, 8.6, 8.7, Text Book 2: 9.7, 9.8, 9.9.												
<b>MODULE-3</b>											<b>LINEAR DIFFERENTIAL EQUATIONS WITH CONSTANT COEFFICIENTS</b>	<b>22DMAT41.3</b>	<b>8 Hours</b>
Solution of initial and boundary value problems, Inverse differential operator techniques for the functions- $e^{ax}$ , $\sin(ax + b)$ and $\cos(ax + b)$ .													
Text Book	Text Book 1: 13.3, 13.4, 13.5, 13.6,												
<b>MODULE-4</b>											<b>LAPLACE TRANSFORM</b>	<b>22DMAT41.4</b>	<b>8 Hours</b>
Definition and Laplace transforms of elementary functions-Problems. Properties of Laplace transforms (Shifting property-without proof), Periodic functions (without proof)-problems.													
Text Book	Text Book 1: 21.3, 21.4, 21.5, Text Book 2: 6.1.												
<b>MODULE-5</b>											<b>INVERSE LAPLACE TRANSFORM</b>	<b>22DMAT41.4</b>	<b>8 Hours</b>
Inverse Laplace Transform by partial fractions-Problems. Solution of linear differential equations using Laplace Transforms-Problems.													
Text Book	Text Book 1: 21.12, 21.15, Text Book 2: 6.4.												
<b>CIE Assessment Pattern (50 X 2=100 Marks - Theory)</b>													
<b>RBT Levels</b>		<b>Marks Distribution</b>											
		<b>Test (s)</b>	<b>Qualitative Assessment (s)</b>	<b>MCQ's</b>									
		<b>25</b>	<b>15</b>	<b>10</b>									
<b>L1</b>	<b>Remember</b>	5	5	-									
<b>L2</b>	<b>Understand</b>	5	5	-									
<b>L3</b>	<b>Apply</b>	10	5	10									

<b>L4</b>	<b>Analyze</b>	2.5	-	-	
<b>L5</b>	<b>Evaluate</b>	2.5	-	-	
<b>L6</b>	<b>Create</b>	-	-	-	

**Suggested Learning Resources:**

**Text Books:**

- 1) B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, Forty fourth Edition, 2022, ISBN: 9788193328491.
- 2) Erwin Kreyszig, Advanced Engineering Mathematics, Wiley-India Publishers, Tenth Edition, Reprint 2016, ISBN: 9788126554232.

**Reference Books:**

- 1) Glyn James, Advanced Modern Engineering Mathematics, Pearson Education, Fourth Edition, 2015, ISBN: 9780273719236.
- 2) B. V. Ramana, Higher Engineering Mathematics, McGraw Hill Education (India) Private Limited, Fourth Edition, 2017, ISBN: 9780070634190.
- 3) H. K. Dass, Advanced Engineering Mathematics, S. Chand & Company Ltd., Twenty Second Edition, 2018, ISBN: 9789352533831.
- 4) N.P.Bali and Manish Goyal, A Text Book of Engineering Mathematics, Laxmi Publications (P) Ltd., Ninth Edition, 2014, ISBN: 9788131808320.

**Web links and Video Lectures (e-Resources):**

- 1) <https://youtu.be/SaNDPSk1UVM?si=FRxMnRi1btCUIscK>
- 2) <https://youtu.be/HxrLu-qRJKc?si=pKc9XOCllBx-H4Wp>
- 3) [https://youtu.be/ma1QmE1SH3I?si=Hoo3\\_cjiIds203os](https://youtu.be/ma1QmE1SH3I?si=Hoo3_cjiIds203os)
- 4) <https://youtu.be/TKBXey91Gc4?si=JjZfQvJxdxN8I6YQ>
- 5) [https://youtu.be/1THkFmulIPXM?si=pc9VvmZ-9cQe\\_Wr\\_](https://youtu.be/1THkFmulIPXM?si=pc9VvmZ-9cQe_Wr_)
- 6) <https://youtu.be/m7jH0jfrf2I?si=OOEWttfQhieJ9wih>
- 7) <https://youtu.be/qFnoRfZknBY?si=BeMrhMF3LML4hBGa>
- 8) <https://youtu.be/n9XP6pljtw8?si=3gU-XXgt5JlZe9LE>

**Activity-Based Learning (Suggested Activities in Class)/Practical Based Learning:**

- Contents related activities (Activity-based discussions)
  - For active participation of students, instruct the students to prepare Algorithms/Flowcharts/Programming Codes
  - Organizing Group wise discussions on related topics
  - Seminars

### Appendix A: List of Assessment Patterns

S.NO	Pattern of Assessments
1	Assignments
2	Group Discussions
3	Case Study / Caselets
4	Practical-Orientation on Design Thinking
5	Participatory & Industry-Integrated Learning
6	Practical Activities / Problem Solving Exercises
7	Class Presentations
8	Analysis of Industry / Technical / Business Reports
9	Reports on Industrial Visit
10	Industrial / Social / Rural Projects
11	Participation in external seminars / Workshops
12	Any Other Academic Activity
13	Online / Offline Quizzes

## APPENDIX B: Outcome Based Education

**Outcome-based education (OBE)** is an educational theory that bases each part of an educational system around goals (outcomes). By the end of the educational experience each student should have achieved the goal. There is no specified style of teaching or assessment in OBE; instead classes, opportunities, and assessments should all help students achieve the specified outcomes.

There are three educational Outcomes as defined by the National Board of Accreditation:

**Program Educational Objectives:** The Educational objectives of an engineering degree program are the statements that describe the expected achievements of graduate in their career and also in particular what the graduates are expected to perform and achieve during the first few years after graduation. [nbaindia.org]

**Program Outcomes:** What the student would demonstrate upon graduation. Graduate attributes are separately listed in Appendix C

**Course Outcome:** The specific outcome/s of each course/subject that is a part of the program curriculum. Each subject/course is expected to have a set of Course Outcomes

### Mapping of Outcomes



## APPENDIX C: The Graduate Attributes of NBA

**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

**Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

**Conduct investigations of complex problems:** The problems that cannot be solved by straightforward application of knowledge, theories and techniques applicable to the engineering discipline that may not have a unique solution. For example, a design problem can be solved in many ways and lead to multiple possible solutions that require consideration of appropriate constraints/requirements not explicitly given in the problem statement (like: cost, power requirement, durability, product life, etc.) which need to be defined (modeled) within appropriate mathematical framework that often require use of modern computational concepts and tools.

**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

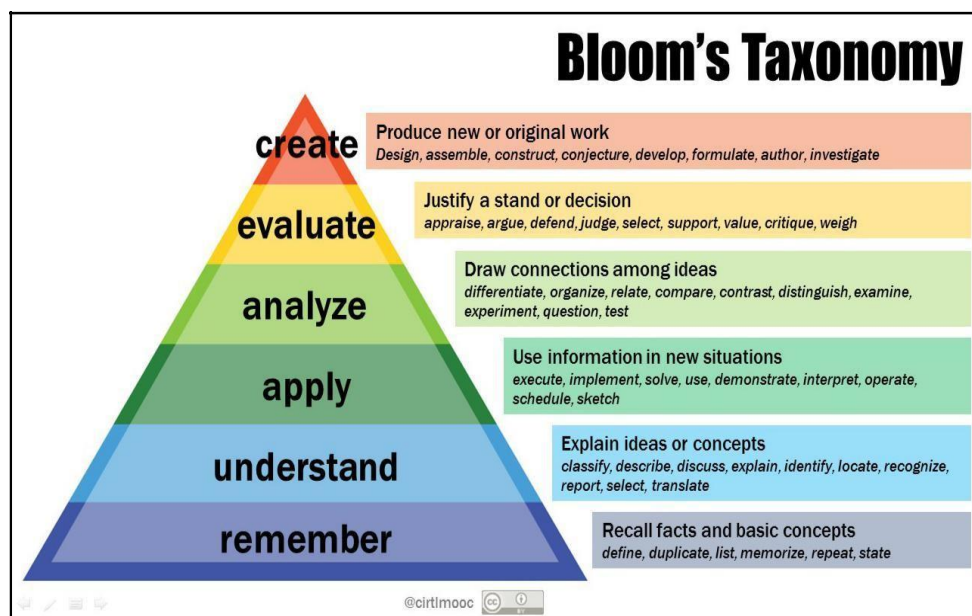
**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

#### APPENDIX D: BLOOM'S TAXONOMY

**Bloom's taxonomy** is a classification system used to define and distinguish different levels of human cognition—i.e., thinking, learning, and understanding. Educators have typically used Bloom's taxonomy to inform or guide the development of assessments (tests and other evaluations of student learning), curriculum (units, lessons, projects, and other learning activities), and instructional methods such as questioning strategies.



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