Government College of Engineering, Aurangabad

(An Autonomous Institute of Government of Maharashtra)
Station Road, Osmanpura, Aurangabad – 431005 (M.S.)
Phone – (0240) 2366101, 2366111, Fax (0240) 2332835

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

(With Effect from Academic Year 2023-24)

Vision of the Institute

- In pursuit of global competitiveness, the institute is committed to excel in engineering education and research with concern for environment and society.

Mission of the Institute

- Provide conducive environment for academic excellence in engineering education.
- Enhance research and development along with promotion to sponsored projects and industrial consultancy.
- Foster development of students by creating awareness for needs of society, sustainable development and human values.

Vision of the Mechanical Engineering Department

- To develop excellence in Mechanical Engineering.

Mission of the Mechanical Engineering Department

- Impart sound knowledge and technical skills through conducive ambiance with right attitude towards society and environment.
- Enhance research facilities, collaboration with industry and provide testing and consultancy services.
- Nurture entrepreneurial qualities, creativity and provide motivation for higher education.
- Inculcate self-learning, team work and adoptability to change.

Program Outcomes

Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **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.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **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.
7. **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.

8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **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.
11. **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.
12. **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.

Program Specific Outcomes

1. To identify mechanical engineering related real life issues /problems in industries society and provide feasible solution.
2. To plan and manage the activities in the small, medium and large enterprise as a part of team or as individual.

GENERAL COURSE STRUCTURE & THEME

A. Definition of Credit:

1 Hr. Lecture (L) per week	1 Credit
1 Hr. Tutorial (T) per week	1 Credit
1 Hr. Practical (P) per week	0.5 Credit
2 Hours Practical (P) per week	1 Credit

B. Range of Credits: (B.E./B.Tech. or Equivalent) in Engg. /Tech. with Multidisciplinary Minor: In the light of the fact that a typical NEP Compliant Model Four-year Under Graduate degree program in Engineering has about 176 credits, the total number of credits proposed for the four-year B.Tech./B.E. in Mechanical Engineering with one Multidisciplinary minor degree is kept as **176.**

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Dated: 27th April 2023

C. Semester wise Credit Distribution Structure for Four Year UG Program in Mechanical Engineering with One Multidisciplinary Minor:

Semester		**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**Total Credits**
Basic Science Course	BSC/ESC	**08**	**08**	**-**	**-**	**-**	**-**	**-**	**-**	**16**
Engineering Science Course		**07**	**07**	**-**	**-**	**-**	**-**	**-**	**-**	**14**
Programme Core Course (PCC)	Program Courses	**-**	**02**	**10**	**08**	**12**	**12**	**12**	**-**	**56**
Programme Elective Course (PEC)		**-**	**-**	**-**	**-**	**04**	**06**	**08**	**02**	**20**
Multidisciplinary Minor (MD M)	Multidisciplinary Courses	**-**	**-**	**04**	**04**	**03**	**03**	**-**	**-**	**14**
Open Elective (OE) Other than a particular program		**-**	**-**	**02**	**03**	**03**	**-**	**-**	**-**	**08**
Vocational and Skill Enhancement Course (VSEC)	Skill Courses	**02**	**02**	**-**	**02**	**-**	**02**	**-**	**-**	**08**
Ability Enhancement Course (AEC -01, AEC-02)	Humanities Social Science and Management (HSSM)	**02**	**-**	**-**	**02**	**-**	**-**	**-**	**-**	**04**
Entrepreneurship/Economics/ Management Courses		**-**	**-**	**02**	**02**	**-**	**-**	**-**	**-**	**04**
Indian Knowledge System (IKS)		**-**	**02**	**-**	**-**	**-**	**-**	**-**	**-**	**02**
Value Education Course (VEC)		**-**	**-**	**02**	**02**	**-**	**-**	**-**	**-**	**04**
Research Methodology	Experiential Learning Courses	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**04**	**04**
Comm. Engg. Project (CEP)/Field Project (FP)		**-**	**-**	**02**	**-**	**-**	**-**	**-**	**-**	**02**
Project		**-**	**-**	**-**	**-**	**-**	**-**	**04**	**-**	**04**
Internship/ OJT		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**12**	**12**
Co-curricular Courses (CC)	Liberal Learning Courses	**02**	**02**	**-**	**-**	**-**	**-**	**-**	**-**	**04**
Total Credits (Major)		**21**	**23**	**22**	**23**	**22**	**23**	**24**	**18**	**176**

Students can opt for any of the following as per the rules and regulations given by institute:

1. B. Tech with one Multidisciplinary Minor = Total 176 Credits
2. B. Tech with one Multidisciplinary Minor and One Honor = Total 194 Credits
3. B. Tech with one Multidisciplinary Minor and Honor by Research = Total 194 Credits
4. B. Tech with two Multidisciplinary Minors = Total 190 Credits

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D. Category-wise Courses

1. BASIC SCIENCE COURSE [BSC]

S. No	Category	Course Title	Semester	Hours per week			Total Credits
				Lecture	Tutorial	Practical	
1	BSC	Mathematics – I	I	3	1	0	**04**
2	BSC	Optics, Acoustics and Engineering materials	I	3	0	0	**03**
3	BSC	Lab Physics	I	0	0	2	**01**
4	BSC	Mathematics – II	II	3	1	0	**04**
5	BSC	Battery Science, Lubricants and Green Chemistry	II	3	0	0	**03**
6	BSC	Lab Chemistry	II	0	0	2	**01**
Total Credits							**16**

2. ENGINEERING SCIENCE COURSE [ESC]

S. No	Category	Course Title	Semester	Hours per week			Total Credits
				Lecture	Tutorial	Practical	
1	ESC	Engineering Graphics	I	2	0	0	**02**
2	ESC	Lab Engineering Graphics	I	0	0	4	**02**
3	ESC	Basics of Electrical and Electronics Engineering	I	3	0	0	**03**
4	ESC	Engineering Mechanics	II	3	0	0	**03**
5	ESC	Lab Engineering Mechanics	II	0	0	2	**01**
6	ESC	Design Thinking	II	2	0	0	**02**
7	ESC	Lab Design Thinking	II	0	0	2	**01**
Total Credits							**14**

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3. VOCATIONAL AND SKILL ENHANCEMENT COURSE (VSEC)

S. No	Category	Course Title	Semester	Hours per week			Total Credits
				Lecture	Tutorial	Practical	
1	VSEC	Engineering Exploration	I	0	0	4	**02**
2	VSEC	Workshop Practice-I	II	0	0	4	**02**
3	VSEC	Workshop Practices-II	IV	0	0	4	**02**
4	VSEC	Workshop Practice-III	VI	0	0	4	**02**
Total Credits							**08**

4. HUMANITIES & SOCIAL SCIENCES COURSES [HSSM]

S. No	Category	Course Title	Semester	Hours per week			Total Credits
				Lecture	Tutorial	Practical	
1	Ability Enhancement Course (AEC)	Communication Skills	I	2	0	0	**02**
2	Indian Knowledge System (IKS)	Indian Metallurgy	II	2	0	0	**02**
3	Entrepreneurship/Economics/ Management Courses	Industrial Psychology/ Industrial Engineering	III	2	0	0	**02**
4	Value Education Course (VEC)	Environmental Science	III	2	0	0	**02**
5	Ability Enhancement Course (AEC)	Technical Communication	IV	0	0	4	**02**
6	Entrepreneurship/Economics/ Management Courses	Finance and Accounting	IV	2	0	0	**02**
7	Value Education Course (VEC)	Universal Human Values -II	IV	2	0	0	**02**
Total Credits							**14**

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5. EXPERIENTIAL LEARNING COURSES (ELC)

S. No	Category	Course Title	Semester	Hours per week			Total Credits
				Lecture	Tutorial	Practical	
1	Comm. Engg. Project (CEP)/ Field Project (FP)	Mini Project	III	0	0	4	**02**
2	Project	Project	VII	0	0	8	**04**
3	Research Methodology	Research Methodology	VIII	3	1	0	**04**
4	Internship/ OJT	Internship	VIII	-	-	24	**12**
Total Credits							**22**

6. LIBERAL LEARNING COURSES (CO-CURRICULAR COURSES (CC))

S. No	Category	Course Title	Semester	Hours per week			Total Credits
				Lecture	Tutorial	Practical	
1	CC	Yoga	I	0	0	4	**02**
2	CC	NSS/ Sports/ Clubs Activities	II	0	0	4	**02**
Total Credits							**04**

7. MULTIDISCIPLINARY MINOR (MD M) and OPEN ELECTIVE (OE) OTHER THAN A PARTICULAR PROGRAM

List of Multidisciplinary Minor Courses from other faculties: Total 14 Credits as per GR
Two courses of 4 credits and two courses of 3 credits.
Open electives of 8 credits can be offered from these other faculties.
Two courses of 3 credits and 01 course of 02 credits.

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Specialization	Dramatics	Film Making	Fine Art	Music
Multi-disciplinary Minor - 01	Dramatic Theory, Literature	Videography + Cinematography	Applied Art (Digital Art)	Theory of Indian Music
Multi-disciplinary Minor – 02	Acting	Video Editing and Lighting	Painting (Generative Art)	Ancient and Modern Poetry
Multi-disciplinary Minor – 03	Directing	Story telling Story Boarding	Sculpture (3D-Space)	The Evolution of music
Multi-disciplinary Minor – 04	Playwriting	UI/UX and Animation	Visual Communication (Evolutionary Art)	Music and Film
Multi-disciplinary Minor – 05	Applied Interactive Theatre	Art of Visual Communication	Graphics Art (Print & Printing Art)	Introduction to Electronic and Computer Music
Multi-disciplinary Minor - 06	Technical Theatre	Film & TV Directing	Art Culture	Analysis of Tonal Music

Specialization	Management & Finance	Law	Social Science	Journalism
Multi-disciplinary Minor - 01	Microeconomics	Constitutional Law	Indian Economics	Principles of Communication
Multi-disciplinary Minor – 02	Corporate Social Responsibility	Human Rights & International Law	Introduction to Sociology	Fundamentals of Journalism
Multi-disciplinary Minor – 03	Principles of Accounting	Environmental Law	Geo-Informatics	Cyber Journalism
Multi-disciplinary Minor – 04	Business Intelligence	Civil Procedure Code (CPC)	Introduction to Political Sciences	Basics of Design & Graphics
Multi-disciplinary Minor – 05	Marketing Research	Land Laws including ceiling and other local laws	Corporate sociology	Mass Communication: Concepts and Processes
Multi-disciplinary Minor - 06	Corporate Governance and Business Ethics	Cyber Law	Modern India-Political, Economic & Social Ethos	IT and Online Journalism

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In addition to above courses following Groups are offered as Multidisciplinary Minor by Mechanical Engineering Department

A) Energy Management Group

S. No	Category	Course Title	Semester	Hours per week			Total Credits
				Lecture	Tutorial	Practical	
1	MD M	Photovoltaic Energy System	III	4	0	0	**04**
2	MD M	Energy Management	IV	4	0	0	**04**
3	MD M	Energy Efficiency of Thermal Utility	V	3	0	0	**03**
4	MD M	Sustainable Energy Conversion System	VI	3	0	0	**03**
Total Credits							**14**

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

B) Manufacturing Group

S. No	Category	Course Title	Semester	Hours per week			Total Credits
				Lecture	Tutorial	Practical	
1	MD M	Production Technology	III	4	0	0	**04**
2	MD M	Metrology and Quality Control	IV	4	0	0	**04**
3	MD M	Production Planning and Control	V	3	0	0	**03**
4	MD M	Computer Aided Design	VI	3	0	0	**03**
Total Credits							**14**

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

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In addition to above courses following courses are offered as Open Electives (OE) by Mechanical Engineering Department

S. No	Category	Course Title	Semester	Hours per week			Total Credits
				Lecture	Tutorial	Practical	
1	OE	Industrial Psychology / Engineering Economics / Ethical Values	III	2	0	0	**02**
2	OE	Total Quality Management / Industrial Management / Manufacturing Management	IV	3	0	0	**03**
3	OE	Entrepreneurship Development / Financial Management / IT Management	V	3	0	0	**03**
Total Credits							**08**

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9. HONORS

Student has to choose and One Honor out of the Four Honor groups provided below

A) Additive Manufacturing Group

S. No	Category	Course Title	Semester	Hours per week			Total Credits
				Lecture	Tutorial	Practical	
1	Honors	Additive Manufacturing Technology	V	4	0	0	**04**
2	Honors	Design for Additive Manufacturing	VI	4	0	0	**04**
3	Honors	Additive Manufacturing Design	VII	4	0	0	**04**
4	Honors	3D printing and Applications	VIII	4	0	0	**04**
5	Honors	Mini Project	VIII	0	0	4	**02**
Total Credits							**18**

B) Robotics & Automation Group

S. No	Category	Course Title	Semester	Hours per week			Total Credits
				Lecture	Tutorial	Practical	
1	Honors	Principles of Robotics	V	4	0	0	**04**
2	Honors	Robot Programming and Simulation	VI	4	0	0	**04**
3	Honors	Industrial Automation	VII	4	0	0	**04**
4	Honors	Artificial Intelligence in Robotics	VIII	4	0	0	**04**
5	Honors	Mini Project	VIII	0	0	4	**02**
Total Credits							**18**

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C) Energy System Group

S. No	Category	Course Title	Semester	Hours per week			Total Credits
				Lecture	Tutorial	Practical	
1	Honors	Energy Audit	V	4	0	0	**04**
2	Honors	Energy Efficient Building	VI	4	0	0	**04**
3	Honors	Industrial Safety and Fire Audit	VII	4	0	0	**04**
4	Honors	Heat Exchanger Design	VIII	4	0	0	**04**
5	Honors	Mini Project	VIII	0	0	4	**02**
Total Credits							**18**

D) Mechanical Design Group

S. No	Category	Course Title	Semester	Hours per week			Total Credits
				Lecture	Tutorial	Practical	
1	Honors	Optimum Design	V	4	0	0	**04**
2	Honors	Advanced Machine Design	VI	4	0	0	**04**
3	Honors	Product Design	VII	4	0	0	**04**
4	Honors	Computer Aided Analysis	VIII	4	0	0	**04**
5	Honors	Mini Project	VIII	0	0	4	**02**
Total Credits							**18**

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Teaching and Evaluation Scheme from Academic Year 2023-24 as per NEP - 2020
First Year B. Tech. Program in Mechanical Engineering

Semester – I

Sr. No	Category	Course Code	Course Title	Teaching Scheme			Credits	Continuous Evaluation in terms of Marks				
				L	T	P		ISE I	ISE II	ISE III	ESE	Total
1.	BSC	MABS C1001	Mathematics – I	3	1	0	**4**	15	15	10	60	**100**
2.	BSC	PHBS C1001	Optics, Acoustics and Engineering materials	3	0	0	**3**	15	15	10	60	**100**
3.	BSC	PHBS C1003	Lab Physics	0	0	2	**1**	-	-	25	-	**25**
4.	ESC	MEES C1001	Engineering Graphics	2	0	0	**2**	10	10	-	30	**50**
5.	ESC	MEES C1002	Lab Engineering Graphics	0	0	4	**2**	-	-	50	-	**50**
6.	ESC	EEES C1013	Basics of Electrical and Electronics Engineering	3	0	0	**3**	15	15	10	60	**100**
7.	VSEC	ETVS E1002	Engineering Exploration	0	0	4	**2**	-	25	25	-	**50**
8.	AEC	INAE C1001	Communication Skills	2	0	0	**2**	10	10	-	30	**50**
9.	CC	INCC C1001	Yoga	0	0	4	**2**	-	-	50	-	**50**
Total				**13**	**1**	**14**	**21**	**65**	**90**	**180**	**240**	**575**

Induction Program (Mandatory)	**3 Weeks Duration**
Induction program to be completed at the start of the first year.	• Physical activity • Creative Arts • Universal Human Values • Literary • Proficiency Modules • Lectures by Eminent People • Visits to local Areas • Familiarization to Dept./Branch & Innovations

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Semester – II

Sr. No	Category	Course Code	Course Title	Teaching Scheme			Credits	Continuous Evaluation in terms of Marks				
				L	T	P		ISE I	ISE II	ISE III	ESE	Total
1.	BSC	MABSC1003	Mathematics – II	3	1	0	**4**	15	15	10	60	**100**
2.	BSC	CHBSC1002	Battery Science, Lubricants and Green Chemistry	3	0	0	**3**	15	15	10	60	**100**
3.	BSC	CHBSC1003	Lab Chemistry	0	0	2	**1**	-	-	25	-	**25**
4.	ESC	AMESC1001	Engineering Mechanics	3	0	0	**3**	15	15	10	60	**100**
5.	ESC	AMESC1003	Lab Engineering Mechanics	0	0	2	**1**	-	-	25	-	**25**
6.	ESC	MEESC1003	Design Thinking	2	0	0	**2**	10	10	-	30	**50**
7.	ESC	MEESC1004	Lab Design Thinking	0	0	2	**1**	-	-	25	-	**50**
8.	PCC	MEPCC1001	Basics of Mechanical Engineering	2	0	0	**2**	10	10	-	30	**50**
9.	VSEC	MEVSE1001	Workshop Practice-I	0	0	4	**2**	-	-	50	-	**50**
10.	IKS	MEIKS1001	Indian Metallurgy	2	0	0	**2**	10	10	-	30	**50**
11.	CC	INCCC1002 / INCCC1003 / INCCC1004	N.S.S / Sports / Club Activities	0	0	4	**2**	-	-	50	-	**50**
Total				**15**	**1**	**14**	**23**	**75**	**75**	**205**	**270**	**625**

Level 4.5 Exit Criteria: Mandatory Courses to be completed after first year for obtaining One Year UG Certificate in Mechanical Engineering

Sr. No	Category	Course Code	Course Title	Teaching Scheme			Credits	Continuous Evaluation in terms of Marks				
				L	T	P		ISE I	ISE II	ISE III	ESE	Total
1.	OJT	MEINT1001	Internship	0	0	16	**8**	-	-	100	100	**200**
OR												
2.	VSEC	MEVSE1002	Computer Aided Drafting and Modeling*	0	0	8	**4**	-	-	50	50	**100**
3.	VSEC	MEVSE1003	Programming and Problem Solving*	0	0	8	**4**	-	-	50	50	**100**

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

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Government College of Engineering, Aurangabad
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Tentative Teaching and Evaluation Scheme from Academic Year 2024-25 as per NEP - 2020
Second Year B. Tech. Program in Mechanical Engineering

Semester – III

Sr. No	Category	Course Code	Course Title	Teaching Scheme			Credits	Continuous Evaluation in terms of Marks				
				L	T	P		ISE I	ISE II	ISE III	ESE	Total
1.	PCC		Machine Drawing	3	0	0	**3**	15	15	10	60	**100**
2.	PCC		Machine Drawing Lab	0	0	2	**1**	-	-	-	25	**25**
3.	PCC		Manufacturing Processes	2	0	0	**2**	10	10	-	30	**50**
4.	PCC		Manufacturing Processes Lab	0	0	2	**1**	-	-	-	25	**25**
5.	PCC		Engineering Thermodynamics	2	0	0	**2**	10	10	-	30	**50**
6.	PCC		Engineering Thermodynamics Lab	0	0	2	**1**	-	-	-	25	**50**
7.	MD M		Multidisciplinary Minor	4	0	0	**4**	15	15	10	60	**100**
8.	OE		Open Elective-I	2	0	0	**2**	10	10	-	30	**50**
9.	HSSM		Industrial Psychology/ Industrial Engineering	2	0	0	**2**	10	10	-	30	**50**
10.	VEC		Environmental Science	2	0	0	**2**	10	10	-	30	**50**
11.	FP / CEP		Mini Project	0	0	4	**2**	-	-	25	25	**50**
Total				**17**	**0**	**10**	**22**	**80**	**80**	**45**	**370**	**575**
Open Elective - I												

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Semester – IV

Sr. No	Category	Course Code	Course Title	Teaching Scheme			Credits	Continuous Evaluation in terms of Marks				
				L	T	P		ISE I	ISE II	ISE III	ESE	Total
1.	PCC		Material Science and Metallurgy	3	0	0	**3**	15	15	10	60	**100**
2.	PCC		Material Science and Metallurgy Lab	0	0	2	**1**	-	-	-	25	**25**
3.	PCC		Strength of Materials	3	0	0	**3**	15	15	10	60	**100**
4.	PCC		Strength of Materials Lab	0	0	2	**1**	-	-	-	25	**25**
5.	MD M		Multidisciplinary Minor	4	0	0	**4**	15	15	10	60	**100**
6.	OE		Open Elective-II	3	0	0	**3**	15	15	10	60	**100**
7.	VSEC		Workshop Practices-II	0	0	4	**2**	-	-	25	25	**50**
8.	AEC		Technical Communication	0	0	4	**2**	-	-	50	-	**50**
9.	HSSM		Finance and Accounting	2	0	0	**2**	10	10	-	30	**50**
10.	VEC		Universal Human Values -II	2	0	0	**2**	-	-	50	-	**50**
Total				**16**	**0**	**12**	**22**	**70**	**70**	**165**	**345**	**650**
Open Elective -- II												

Level 5.0 Exit Criteria

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

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

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

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Dated: 27th April 2023

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Tentative Teaching and Evaluation Scheme from Academic Year 2025-26 as per NEP - 2020
Third Year B. Tech. Program in Mechanical Engineering

Semester – V

Sr. No	Category	Course Code	Course Title	Teaching Scheme			Credits	Continuous Evaluation in terms of Marks				
				L	T	P		ISE I	ISE II	ISE III	ESE	Total
1.	PCC		Machine Design - I	2	1	0	**3**	15	15	10	60	**100**
2.	PCC		Machine Design - I Lab	0	0	2	**1**	-	-	-	25	**25**
3.	PCC		Theory of Machines	2	0	0	**2**	10	10	-	30	**50**
4.	PCC		Lab- Theory of Machines	0	0	2	**1**	-	-	-	25	**25**
5.	PCC		Mathematics for Mechanical Engineer / NACM	2	0	0	**2**	10	10	-	30	**50**
6.	PCC		Fluid Mechanics & Turbo machine	2	0	0	**2**	10	10	-	30	**50**
7.	PCC		Fluid Mechanic & Turbo machine Lab	0	0	2	**1**	-	-	-	25	**25**
8.	PEC		Program Elective- I	3	0	0	**3**	15	15	10	60	**100**
9.	PEC		Program Elective - I Lab	0	0	2	**1**	-	-	-	25	**25**
10.	MD M		Multidisciplinary Minor	3	0	0	**3**	15	15	10	60	**100**
11.	OE		Open Elective-III	3	0	0	**3**	15	15	10	60	**100**
Total				**17**	**1**	**8**	**22**	**90**	**90**	**40**	**430**	**650**

Professional Elective - I	**Open Elective - III**
1. Metrology and Quality Control 2. Mechanical Measurements 3. Design for Manufacturing and Assembly	

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Semester – VI

Sr. No	Category	Course Code	Course Title	Teaching Scheme			Credits	Continuous Evaluation in terms of Marks				
				L	T	P		ISE I	ISE II	ISE III	ESE	Total
1.	PCC		Heat & Mass Transfer	2	0	0	**2**	10	10	-	30	**50**
2.	PCC		Heat & Mass Transfer Lab	0	0	2	**1**	-	-	-	25	**25**
3.	PCC		Mechatronics	2	0	0	**2**	10	10	-	30	**50**
4.	PCC		Mechatronics Lab	0	0	2	**1**	-	-	-	25	**25**
5.	PCC		Machine Design- II	3	0	0	**3**	15	15	10	60	**100**
6.	PCC		Tool Design	3	0	0	**3**	15	15	10	60	**100**
7.	PEC		Professional Elective - II	3	0	0	**3**	15	15	10	60	**100**
8.	PEC		Professional Elective - II Lab	0	0	2	**1**	-	-	-	25	**25**
9.	PEC		Professional Elective - III	2	0	0	**2**	10	10	-	30	**50**
10.	MD M		Multidisciplinary Minor	3	0	0	**3**	15	15	10	60	**100**
11.	VSEC		Workshop Practice-III	0	0	4	**2**	-	-	25	25	**50**
Total				**18**	**0**	**10**	**23**	**95**	**95**	**75**	**460**	**675**

Professional Elective - II	**Professional Elective III**
1. Power plant Engineering	1. Automatic Control System
2. IC Engine	2. Hybrid and Electric Vehicle
3. Renewable Energy Engineering	3. Robotics & Automation
4. Additive Manufacturing	4. Fuel Cells and Hydrogen

Level 5.5 Exit Criteria

Mandatory Courses to be completed after Third Year for obtaining Three Year Bachelor's Degree in Vocation (B. Voc.) in Mechanical Engineering

Sr. No	Category	Course Code	Course Title	Teaching Scheme			Credits	Continuous Evaluation in terms of Marks				
				L	T	P		ISE I	ISE II	ISE III	ESE	Total
1.	OJT		Internship	0	0	16	**8**	-	-	100	100	**200**
OR												
2.	VSEC		Application of MATLAB for Mechanical Engineering*	0	0	8	**4**	-	-	50	50	**100**
3.	VSEC		Minor Project	0	0	8	**4**	-	-	50	50	**100**

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

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Government College of Engineering, Aurangabad
(An Autonomous Institute of Government of Maharashtra)

Tentative Teaching and Evaluation Scheme from Academic Year 2026-27 as per NEP - 2020
Final Year B. Tech. Program in Mechanical Engineering

Semester – VII

Sr. No	Category	Course Code	Course Title	Teaching Scheme			Credits	Continuous Evaluation in terms of Marks				
				L	T	P		ISE I	ISE II	ISE III	ESE	Total
1.	PCC		Heating Ventilation, Air Conditioning and Refrigeration	3	0	0	**3**	15	15	10	60	**100**
2.	PCC		Heating Ventilation, Air Conditioning and Refrigeration Lab	0	0	2	**1**	-	-	-	25	**25**
3.	PCC		CAD, CAM & CAE	3	0	0	**3**	15	15	10	60	**100**
4.	PCC		CAD, CAM & CAE lab	0	0	2	**1**	-	-	-	25	**25**
5.	PCC		Artificial Intelligence and Machine Learning	3	0	0	3	15	15	10	60	**100**
6.	PCC		Artificial Intelligence and Machine Learning Lab	0	0	2	1	-	-	-	25	**25**
7.	PEC		Professional Elective - IV	3	0	0	**3**	15	15	10	60	**100**
8.	PEC		Professional Elective - IV Lab	0	0	2	**1**	-	-	-	25	**25**
9.	PEC		Professional Elective - V	3	0	0	**3**	15	15	10	60	**100**
10.	PEC		Professional Elective – V Lab	0	0	2	**1**	-	-	-	25	**25**
11.	ELC		Project	0	0	8	**4**	-	-	100	100	**200**
Total				**15**	**0**	**18**	**24**	**75**	**75**	**150**	**525**	**820**

Professional Elective - IV	**Professional Elective - V**
1. Tribology	1. Finite Element Analysis
2. Production and Operation Management	2. Mechanics of Composite Materials
3. Mechanism Design	3. Advanced Production Processes
4. Automobile Engineering	4. Computational Fluid Dynamics

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Semester – VIII

Sr. No	Category	Course Code	Course Title	Teaching Scheme			Credits	Continuous Evaluation in terms of Marks				
				L	T	P		ISE I	ISE II	ISE III	ESE	Total
1.	PEC		Professional Elective – VI*	2	0	0	**2**	10	10	-	30	**50**
2.	ELC		Research Methodology*	3	1	0	**4**	15	15	10	60	**100**
3.	OJT		Internship	-	-	24	**12**	-	-	100	100	**200**
Total				**5**	**1**	**24**	**18**	**25**	**25**	**110**	**190**	**350**

Professional Elective - VI

1. Design of Heat Exchanger
2. Introduction to Nuclear Engineering
3. Steam Technology
4. Computational Convective Heat Transfer
5. Electrical Vehicle Design

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

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MABSC1001: Mathematics – I		
Teaching Scheme	**Examination Scheme**	
Lectures: 03 Hrs / Week	**ISE I**	**15 Marks**
Tutorial: 01 Hrs / Week	**ISE II**	**15 Marks**
Credits: 04	**ISE III**	**10 Marks**
	End Semester Examination	**60 Marks**

Course Description: MABSC1001: Mathematics-I is compulsory course for first year B. Tech. Civil Engineering, Mechanical Engineering., Computer Science & Engineering and Information Technology students.

Course Outcomes:

After completing the course students will able to

Course Outcomes		Bloom's Taxonomy Level	Unit
CO1	Define Beta, Gamma and error functions and find the roots of Complex Numbers, Rank of Matrix, limit of function, series expansion and maxima – minima of functions, asymptotes of given curves.	K1	1,2,3,4,5
CO2	Summaries the Complex Numbers; Explain the Rank of Matrix, successive differentiation, Special functions (Beta and Gamma functions)	K2	1,2,3,4,5
CO3	Identify the real and imaginary part of logarithm of complex numbers, eigen values and eigen vectors.	K2	1,2
CO4	Solve the system of linear equations using Gauss elimination and Gauss Jordan Method, Leibnitz's theorem, definite integrals using Beta and Gamma functions and definite integrals using rule of Differentiation under integral sign.	K2	2,3,4
CO5	Apply De-Moivre's theorem, Cayley Hamilton theorem, knowledge of integral calculus and sketch the approximate shape of the curves.	K3	1,2,4,5

Detailed Syllabus:

Unit 1	**Complex Numbers** Definition of complex numbers, Argand Diagram, De-Moivre's theorem and its application to find roots of algebraic equations, expansions of trigonometric functions, Circular and Hyperbolic functions inverse Hyperbolic functions, Logarithm of complex numbers, separation into real and imaginary parts.
Unit 2	**Matrices** Rank of matrix, echelon form of matrix, normal form of matrix, algebraic system of m linear equations in n unknowns, Gauss elimination and Gauss Jordan elimination method, linear dependence and independence of vectors, orthogonal matrix, linear transformations, matrix of linear transformation, rank nulity theorem, Eigen values and Eigen vectors, Cayley Hamilton theorem and its applications.
Unit 3	**Differential Calculus** nth order ordinary derivatives of elementary functions, Leibnitz's theorem, expansion of function in power series, Taylor's series, Maclaurin's series indeterminate forms and L'hospital rule, maxima and minima, converge of sequence

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	and series, range of convergence of power series, test of convergence – ratio test and comparison test.
Unit 4	**Integral Calculus** Beta function, Gamma function, rules of Differentiation Under Integral Sign, error function, application of definite integrals to evaluate surface area and volume of revolutions.
Unit 5	**Curve Tracing and its applications** Tracing of cartesian curves, polar curves and parametric equations, rectification of plane curves: cartesian and polar.

Text and Reference Books

1. Erwin Kreyszing, Advanced Engineering Mathematics,10th Edition, Mumbai: Willey Eastern Ltd. 2015.
2. B. S. Grewal, Higher Engineering Mathematics, 44th Edition, New Delhi: Khanna publication, 2017.
3. Ramana B.V. Higher Engineering Mathematics,11 th Reprint, New Delhi: Tata McGraw Hill, 2010.
4. David Poole, Linear Algebra: A Modern Introduction, 3rd Edition, USA: BROOKS/COLE CENGAGE Learning, 2011.
5. Ravish R. Singh, Mukul Bhatt, Engineering Mathematics- A tutorial approach, 4th Edition, New Delhi: Tata McGraw Hill Education Pvt. Ltd.2018.
6. Dass H. K. Advanced Engineering Mathematics, 22nd Edition, New Delhi: S. Chand publications, 2018.
7. P. N. Wartikar and J. N. Wartikar, A text book of Engineering Mathematics (Vol. 1 & 2), Reprint, Pune: Pune Vidhyarthi Griha Prakashan, 2013.

Assessment: ISEI, II, III (Class Test-1, Class Test-2, TA) & ESE

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

1. Surprise Test
2. Assignment using Mathematical tools like Mathematica/MATLAB or similar.
3. Quiz
4. Any other activity suggested by course coordinator

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I (Class Test-1)	ISE II (Class Test-2)	ISE III (TA + Surprise Test)	End Semester Examination
K1	Remember	5	5		
K2	Understand	10	10		60
K3	Apply			10	
K4	Analyze				
K5	Evaluate				
K6	Create				
Total Marks 100		15	15	10	60

Mapping of Course outcomes with Program outcomes:

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

1 – Low, 2 – Medium, 3 – High

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PHBSC1001: Optics, Acoustics and Engineering Materials		
Teaching Scheme	**Examination Scheme**	
Lectures: 03 Hrs. / Week	**ISE I**	**15 Marks**
Credits: 03	**ISE II**	**15 Marks**
	ISE III	**10 Marks**
	End Semester Examination	**60 Marks**

Course Description: The course is mandatory course for first year B. Tech. Civil, Mechanical and Electrical Engineering programs in first semester. The course objective is to teach fundamental principles in Physics and relate the understanding to applications.

Course Outcomes:

After completing the course students will able to

Course Outcomes		Bloom's Taxonomy Level
CO1	Define interference, thin film interference, Fraunhofer diffraction, resolving power, polarization, double refraction, Free, damped and forced oscillations, resonance, state features of magnetic and dielectric materials, acoustical demands of building, methods of production of ultrasonics, types of energy bands.	K1
CO2	Explain the concepts interference, diffraction, polarization, dielectric and magnetic properties, semiconductors, architectural acoustics and ultrasonics, oscillations, resonance, wave motion,	K2
CO3	Illustrate the engineering applications of interference, diffraction, polarization, dielectric and magnetic properties, semiconductors and ultrasonics	K3
CO4	Identify, formulate and solve physical problems related to engineering	K4
CO5	Apply the fundamental principles of interference, diffraction, polarization, dielectric and magnetic properties, semiconductors, architectural acoustic and ultrasonic in engineering context	K5

Detailed Syllabus:

Unit 1	**Optics-** Interference- Interference due to thin film of uniform thickness, wedge shaped film, Newton's rings formation and theory, Anti-reflection coating. Diffraction- Fraunhofer diffraction at single slit (geometrical method), Conditions for maxima and minima, Double slit Diffraction, Plane diffraction grating, Rayleigh's criterion of resolution, resolving power of grating. Polarization- Polarization by reflection, Polarization by double refraction, Phase difference and path difference, Quarter wave plate, Half wave plate, Superposition of e-ray and o-ray, Production of circularly and elliptically polarized light, Polaroid sheets.
Unit 2	**Acoustics and ultrasonics** Acoustics- classification of sound, musical sound, noise, characteristics of musical sounds-pitch, loudness or intensity, measurement of intensity level, decibel, quality or timbre, reflection of sound, echo, reverberation, reverberation time, absorption of sound, absorption coefficient, Sabine's formula with derivation, factors affecting architectural acoustics.

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	Ultrasonics- Production of ultrasonic waves by piezoelectric and magnetostriction method, engineering applications of ultrasonic waves.
Unit 3	**Engineering Materials-** Dielectric properties of material- dielectric constant, induced dipole, permanent dipole, polarization in dielectric materials, types of polarization, polar and non-polar dielectrics, frequency dependence of dielectric constant, applications of dielectric materials. Magnetic materials- review of basic concepts magnetization, magnetic susceptibility, relative permeability, classification of diamagnetic, paramagnetic and ferromagnetic materials, domain hypothesis, hysteresis or BH curve in ferromagnetic materials, soft and hard magnetic materials, applications.
Unit 4	**Semiconductors-** Band theory of Solids, Classification of solids on the basis of energy band theory, Fermi-Dirac statistics, Concept of Fermi level and its variation with temperature, Density of states, Position of Fermi level in intrinsic semiconductor (with derivation) and in extrinsic semiconductor, Conductivity of semiconductor, Working of p-n junction from energy band diagram- forward and reverse biased, Hall effect in semiconductor.
Unit 5	**Oscillations -** Free, damped and forced oscillations, resonance, theory of resonant oscillations-condition for amplitude resonance, sharpness of resonance, differential equation of wave motion, damped harmonic motion- over damped, critically damped and under damped cases, transverse vibrations of stretched string.

Text and Reference Books

1. M. N. Avadhanulu, and P. G. Kshirsagar. *A Textbook Of Engineering Physics*, 5th ed. New Delhi: S. Chand and company Ltd., 2014
2. R. K. Gaur, S. L. Gupta. *Engineering Physics*, 14th ed. New Delhi: Dhanpat Rai and Sons Publications, 2012
3. M. R. Srinivasan, *Physics for Engineers*, 2nd ed. New Delhi: New Age International Publishers, 2009.
4. D. Halliday, and R. Resnic. *Fundamentals of Physics*, 9th ed. Noida: John–Wiley and Sons, 2010
5. Arthur Beiser, *Perspectives of modern Physics*, Mc-Graw Hill, US, 1969

Assessment: ISE I-Class Test-I of Maximum Marks-15
ISE II-Class Test-II of Maximum Marks-15
ISE III- Teacher's Assessment: Teachers Assessment of 10 marks is based on one of the / or combination of surprise test, assignment, quiz, any other activity suggested by course coordinator

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Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	5	5	2	12
K2	Understand	5	5	6	18
K3	Apply	5	5	2	12
K4	Analyze				12
K5	Evaluate				6
K6	Create				
Total Marks 100		15	15	10	60

Assessment table:

Course Outcome	CO1	CO2	CO3	CO4	CO5
Assessment Tool	K1	K2	K3	K4	K5
ISEI Class Test-I (15 Marks)	5	5	5		
ISEII Class Test-II (15 Marks)	5	5	5		
IS III TA(10 Marks)	2	6	2		
ESE Assessment (60 Marks)	12	18	12	12	6
Total Marks 100	24	34	24	12	6

Mapping of Course outcomes with Program outcomes:

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

1 – Low, 2 – Medium, 3 – High

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PHBSC1003: Lab Physics		
Teaching Scheme	**Examination Scheme**	
Practical: 02 Hrs. / Week	**ISE III**	**25 Marks**
Credit: 01		

Course Outcomes:

After completing the course students will able to

Course Outcomes	
CO1	Demonstrate basic laws of Physics with experimental process
CO2	Conduct experiments to understand the relationship between variables in physical problems
CO3	Interpret experimental data to examine the physical laws
CO4	Illustrate the relevance between theoretical knowledge and means to imply it in a practical manner by performing various experiments
CO5	Work in teams and understand the effective team dynamics.

List of the Experiments:

The student shall perform minimum eight experiments of the following:

Sr. No.	Title of the Experiments	Skill / Knowledge Level	CO
1	e/m by Thomson's method.	S1/K2	CO3
2	Determination of radius of curvature of Plano-convex lens by Newton's ring.	S1/K1	CO1
3	Determination of the wavelength of light of a given source using diffraction grating.	S1/K2	CO1
4	Resolving power of telescope.	S1/K2	CO3
5	Study of C.R.O (amplitude and frequency measurement).	S1/K1	CO5
6	Specific rotation of sugar solution by Laurent's half shade polarimeter.	S1/K2	CO4
7	Determination of band gap of a semiconductor.	S1/K2	CO3
8	To study temperature dependence of resistivity of a semiconductor using four probe method.	S1/K2	CO3, CO5
9	To determine the Hall coefficient of a semiconductor material and then evaluate carrier type and its density of charge carrier.	S1, S3/K2	CO1
10	Study of solar cell characteristics.	S1/K1	CO2, CO5
11	Determination of wavelength of Laser using grating.	S1, S2/K2	CO3
12	Determination of numerical aperture of an optical fiber.	S1, S3/K2	CO3
13	To plot the hysteresis loop of a given magnetic material (iron).	S1/K2	CO2
14	To study characteristics of photovoltaic cell.	S1/K2	CO3
15	Study of divergence of Laser beam.	S2, S3/K2	CO2, CO5
16	To measure thickness of fine wire and grating element with the help of Laser source.	S1/K2	CO1
17	To draw V/I characteristics of forward & reverse biased P-N junction diode.	S1, S3/K2	CO3
18	Determination of velocity of sound through water using ultrasonic interferometer.	S1, S3/K2	CO3

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Assessment:
ISE III- Continuous Assessment of individual student in a batch during each experiment
Maximum Marks-25

Assessment Pattern:

Assessment Pattern Level No.	**Knowledge Level**	**ISE III**
K1	Remember	10
K2	Understand	15
K3	Apply	
K4	Analyze	
K5	Evaluate	
K6	Create	
Total Marks		25

Assessment Pattern Level No.	**Knowledge Level**	**ISE III**
S1	Imitation	15
S2	Manipulation	05
S3	Precision	05
Total Marks		25

Mapping of Course outcomes with Program outcomes:

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

1 – Low, 2 – Medium, 3 – High

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MEESC1001: Engineering Graphics (For MECH/ETC/CSE/IT)		
Teaching Scheme	**Examination Scheme**	
Lectures: 02 Hrs. / Week	**ISE I**	**10 Marks**
Credits: 02	**ISE II**	**10 Marks**
	End Semester Examination	**30 Marks**

Course Description: All engineering activities (design/ manufacturing/ operation/ servicing) for any product from any discipline involve a team of people who communicate graphically. Hence, every engineer must have exposure and some competence in presenting ideas as pictures, and be able to unambiguously interpret drawing from others. This course will help develop basic visualization competency as well as ability to representing ideas on both paper and computer.

Course Outcomes:

After completing the course students will able to

Course Outcomes	
CO1	Understand concept of projection of line application in design.
CO2	Apply the concept to draw the basic views related to projections of Planes
CO3	Gain knowledge about orthographic projections
CO4	Sketch the different concepts of isometric projections

Detailed Syllabus:

Unit 1	**Projections of Lines and Planes** Projections of Straight Lines: Introduction to point, Projections of points in four quadrants, projections of points in reference plane, Introduction and concept of line, cases: - line parallel to both the plane, line parallel to one plane and perpendicular to the other. Plane cases: surface parallel to one reference plane and perpendicular to other reference plane, plane surface inclined to one reference plane and perpendicular to other reference, projections of planes inclined to both reference planes
Unit 2	**Orthographic Projections:** Types of lines, methods of dimensioning and types of dimensioning, Principle of orthographic projections (First and third angle orthographic projection methods) Exercise shall be consist of orthographic projection of different machine parts problem by first angle orthographic projection methods, all types sectional orthographic projections (First angle orthographic projection methods). Sectional view problem shall be solving consist of various mechanical components and by First angle orthographic projection methods.
Unit 3	**Isometric view:** Isometric Views: Introduction to pictorial views, isometric scale, isometric projections and different machine parts isometric views problems on various mechanical components.

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Text and Reference Books

1. Engineering Graphics with an introduction to computer aided drafting, vol. I & II, H. G. Phakatkar, Nirali Prakashan, Pune. Feb 2007 onwards.
2. A Text book of Engineering Drawing, P.J. Shah, S. Chand & company Ltd., New Delhi. 2009
3. Engineering Drawing, R. V. Mali & Chaudhari, Vrinda Publication, Jalgaon 1998 onwards.
4. Kulkarni, D. M., Rastogi, A. P. and Sarkar, A. K., Engineering Graphics with AutoCAD, PHI 2009
5. Engineering Drawing and Graphics + AutoCAD, K. Venugopal, New Age International Publishers, New Delhi,2007
6. Engineering Drawing, Bhatt N. D., Panchal V. M., Charotar Publishing House 2008 onwards
7. Engineering Graphics, Vol.-I and Vol.-II, Dhabhade M. L., Vision Publications 2003 onwards
8. Engineering drawing – P.S Gill, S. K. Kataria publication.2012 onwards.

Assessment:

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

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

Assessment Pattern:

Assessment Pattern LevelNo.	Knowledge Level	ISE I	ISE II	End Semester Examination
K1	Remember			
K2	Understand	5	5	9
K3	Apply	5	5	12
K4	Analyze			9
K5	Evaluate			
K6	Create			
Total Marks 50		10	10	30

Assessment table:

Assessment Tool	K2, K3	K2, K3	K2, K3	K4
	CO1	CO2	CO3	CO4
ISE I (10 Marks)	5	5		
ISE II (10 Marks)			10	
	K2 to K4	**K2 to K4**	**K2 to K4**	**K2 to K4**
ESE Assessment (30 Marks)	6	6	6	6
Total Marks 50	11	11	16	6

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Mapping of Course outcomes with Program outcomes:

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

1 – Low, 2 – Medium, 3 – High

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MEESC1002: Lab Engineering Graphics		
Teaching Scheme	**Examination Scheme**	
Practical: 04 Hrs. / Week	**ISE III**	**50 Marks**
Credit: 02		

Course Outcomes:

After completing the course students will able to

Course Outcomes	
CO1	Understand the conventions and the methods of engineering drawing
CO2	Improve their visualization skills so that they can apply these skills in developing new Products.
CO3	Become proficient in drawing the projections of various machine components.

List of the Experiments:

The student shall perform following experiments:

Sr. No.	Title of the Experiments
1	Introduction to Computer Graphics (CAD) Demonstrating of the theory of CAD software, Standard Toolbars and Basic operations used like, Object Properties, Draw, Modify and Dimension, Select and erase objects etc. in CAD software package
2	Drawing Five problems based on projections of lines on drawing sheet
3	Drawing Five problems based on projections of planes on drawing sheet
4	Drawing five problems based on sectional orthographic projections on drawing sheet and 2 problems using CAD software tool.
5	Drawing five problems based on sectional Isometric projections on drawing sheet and 2 problems using CAD software tool.

Assessment Pattern:

Assessment Pattern Level №	**Knowledge Level**	**ISE III**	**ESE**
S1	Imitation	10	
S2	Manipulation	20	
S3	Precision	10	
S4	Articulation	10	
S5	Naturalization		
Total Marks 50		50	

Assessment table:

Assessment Tool	**S1 to S3**	**S1, S2**	**S1**
	CO1	CO2	CO3
ISE III TW (50 Marks)	20	15	15
Total Marks 50	20	15	15

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Mapping of Course outcomes with Program outcomes:

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

1 – Low, 2 – Medium, 3 – High

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EEESC1013: Basics of Electrical and Electronics Engineering		
Teaching Scheme	**Examination Scheme**	
Lectures: 03 Hrs. / Week	**ISE I**	**15 Marks**
Credits: 03	**ISE II**	**15 Marks**
	ISE III	**10 Marks**
	End Semester Examination	**60 Marks**

Course Description: This is the basic course in Electrical Engineering which introduces the basic concepts, different theorem and laws, Electrical circuits to students

Course Objectives:

The objectives of the course are to-

1. Impart a basic knowledge of electrical quantities such as current, voltage, power, energy and frequency
2. Acquaint with basic laws & theorems of electrical networks
3. Explain fundamentals of magnetic circuits and alternating current circuits and solve the circuit problems
4. Identify the electrical machines
5. Illustrate electrical wiring fundamentals, safety devices and metering

Course Outcomes:

After completing the course students will able to

Course Outcomes	
CO1	Explain the fundamental concepts of AC and DC circuits, electromagnetic induction, energy storage systems, electrical wiring, electrical machines, LED and solar lights, electrical accessories and metering devices.
CO2	Apply different theorems and electro-magnetic laws for solving AC-DC electric circuits.
CO3	Calculate the different parameters of DC machines and induction Motors from given data.
CO4	Explain transistor configurations, their comparison and FET devices
CO5	Describe operations of various consumer electronics gadgets

Detailed Syllabus:

Unit 1	**D.C. Circuit** Introduction of circuit active and passive parameter of electrical circuit, Kirchhoff current and voltage laws, Source conversion, series and parallel circuit, current and voltage division rule, Delta-Star and Star-Delta conversion
Unit 2	**Electromagnetic Induction:** Faraday's laws, statically and dynamically induced emf, self and mutual inductance, coefficients of coupling. Magnetic Circuits: Terms related with magnetic circuits, Magnetization curve, Magnetic leakage and fringing, Leakage coefficient, Series and parallel circuits, magnetic hysteresis and eddy current loss
Unit 3	**Introduction of Electrical Machines:** Classification of Electrical Machines, Construction, working and application: single phase transformer, three phase Transformer, Single phase induction motor, Three Induction motors and DC motors (No Numerical) Selection of electrical motors / drives, Types of electric motors, principle of operations and applications

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Unit 4	**Transistors:** BJT, NPN & PNP transistors, structure, working of NPN transistor. Concepts of common base, common emitter & common collector configurations, current gain of each, Input & output characteristics of common emitter configuration, comparison of three configurations with reference to voltage & current gain, input & output resistances and applications. Introduction to JFET, characteristics of MOSFET, CMOS devices
Unit 5	**Consumer Electronics:** Basic operation of Microphone & its Characteristics, Basic operation of Loudspeakers Concept of acoustic, Loudness level, HDTV, CCTV, latest electronic gadgets like Arduino circuits and operations, drivers, controllers, motors

Text and Reference Books

1. L. S. Bobrow, *Fundamentals of Electrical Engineering,* Oxford University Press, 2011.
2. Vincent Del Toro, *Electrical Engineering Fundamentals,* Prentice Hall India, 2nd ed, 2013.
3. Kothari D. P, Nagrathl. J., *Basic Electrical Engineering,* Tata McGraw Hill, 2010.
4. M. S. Naidu, S. Kamakshaiah, *Introduction to Electrical Engineering,* Tata McGraw-Hill, 1995
5. E. Hughes, *Electrical and Electronics Technology,* Pearson, 2010
6. Thomas L. Floyd, *"Electronic Devices",* Pearson Education, 9th ed, 2011
7. David A Bell, *Electronic Devices and Circuits,* Oxford University Press
8. C. S. Rangan, G. R. Sarma, V. S. V. Mani, *Instrumentation: devices and systems,* Tata McGraw- Hill
9. Albert Paul Malvino, *Electronic Principles,* McGraw- Hill

Mapping of Course outcomes with Program outcomes:

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

1 – Low, 2 – Medium, 3 – High

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ETVSE1002: Engineering Exploration		
Teaching Scheme	**Examination Scheme**	
Practicals: 04 Hrs. / Week	**ISE II**	**25 Marks**
Credits: 02	**ISE III**	**25 Marks**

Course Outcomes:

After completing the course students will able to

Course Outcomes	
CO1	Explain the role of an Engineer as a problem solver
CO2	Identify multi-disciplinary approach required in solving an engineering problem
CO3	Build simple mechanisms using engineering design process
CO4	Interface different peripherals to Arduino.
CO5	Apply basics of engineering project management skills.
CO6	Analyze engineering solutions from ethical & sustainability perspectives

Engineering exploration is a Project-based learning (PBL) based course wherein students will apply their technical knowledge, practical skills to develop a project in a team. A group of 5 students (max) normally will be permitted in a team. A set of need statements will be prepared by team members with the help of course coordinators. These need statements will be converted to Problem Statements. Students will follow Engineering Design process to develop conceptual design and detailed design.

Few of the activities which can be carried out are:

- Catapult design, weight bearing structure using newspapers, bridge making, activity with straws, coloured paper, box of straws, football with papers, paper plane.
- How do you think Engineering design case studies for designing Panipuri/ teal coffee vending/pan making vending machines, grass cutter/mower machine, winding machines, chips making machine, home automation etc (block diagram and components in different blocks), Pugh chart examples.
- Building mechanisms using gears and other components, design mechanisms using linkages, auto inventor for model designing.
- Arduino based experimentation and programming.
- Preparation of time lines for project management.
- Presentation of case studies for ethics, sustainability, and carbon footprint.

Detailed Syllabus:

Module 1	**Introduction to Engineering and Engineering Study**	2 hrs
	Introduction to Engineering and Engineering Study: Difference between science and engineering, scientist and engineer needs and wants, various disciplines of engineering, some misconceptions of engineering, Expectation for the 21st century engineer and Graduate Attributes.	
Module 2	**Engineering Design**	15 hrs
	Engineering Design Process, Multidisciplinary facet of design, Pair wise comparison chart, Introduction to mechatronics system, generation of multiple solution, Pugh Chart, Motor and battery sizing concepts, introduction to PCB design	
Module 3	**Mechanisms**	4 hrs
	Basic Components of a Mechanism, Degrees of Freedom or Mobility of a Mechanism,4 Bar Chain, Crank Rocker Mechanism, Slider Crank Mechanism.	

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Module 4	**Platform based-development** 12 hrs Introduction to various platform-based development (Arduino) programming and its essentials, Introduction to sensors, transducers and actuators and its interfacing with Arduino, Introduction to Data Acquisition and Analysis
Module 5	**Project Management** 3 hrs Introduction to Agile practices, Significance of teamwork, Project management tools: Checklist, Timeline, Gantt Chart, Significance of documentation
Module 6	**Sustainability and Ethics in Engineering** 4 hrs Introduction to sustainability, Sustainability leadership, carbon footprint Identifying Engineering as a Profession, Significance of Professional Ethics, Code of Conduct for Engineers, Identifying Ethical Dilemmas in different tasks of engineering, Plagiarism check for research papers
Total Contact Hours	40 Hrs
Course Project Reviews Evaluation of group projects	08 hrs

Evaluation Scheme			
Name of the Module	Hours	Marks	Evaluation
1.Introduction to Engineering & Engineering Study	02	3	ISE - II
2. Engineering Design	15	10	
3. Mechanisms	04	2	
4. Platform based development	12	10	
5. Project Management	03	5	ISE - III
6. Sustainability and ethics in Engineering	04	5	
7. Course Project Reviews	08	10	
8.Honor code	-	5	
TOTAL	48	50	

	CO1	**CO2**	**CO3**	**CO4**	**CO5**	**CO6**	**Total**
ISE II	03	10	02	10			25
ISE III		05		05	05	10	25

Mapping of Course outcomes with Program outcomes:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1				1					1	1
CO2	2	2	2	1	1				3	1		
CO3	2	2	3	2	2	1	1		3	1	2	
CO4	2	2	2	2	2				1	1	2	1
CO5		2	2	2	2	1	1	1	3	1	3	
CO6						1	3	3				

1 – Low, 2 – Medium, 3 – High

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INAEC1001: Communication Skills		
Teaching Scheme	**Examination Scheme**	
Lectures: 02 Hrs. / Week	**ISE I**	**10 Marks**
Credits: 02	**ISE II**	**10 Marks**
	End Semester Examination	**30 Marks**

Course Description: Communication Skills (INAEC1001) is a one semester compulsory course for the first-year students of all disciplines of the institute.
The course is aimed at introducing the basic of the communication skills. The goal of the course is to improve listening, speaking, reading and writing skills. Thus, the stress in the syllabus in primarily on the development of communicative skills and fostering of ideas.

Course Outcomes:
After completing the course students will able to

Course Outcomes	
CO1	Analyze the situation and overcome the barriers in speaking English and get the ability to communicate in professional as well as day to day life.
CO2	Develop personality through corporate etiquettes and take active participation in discussion and other academic activities as well.
CO3	Apply proper words and structure in speaking English language and develop vocabulary and use of correct English.
CO4	Express them through oral as well as written communication and develop written communication for professional and business purpose.
CO5	Use of E-Communication in day to day as well as professional life

Detailed Syllabus:

Unit 1	**Communication Skills & Soft Skills** Basic concept, factor's, process and types of communication, principles of effective communication, barriers of communication, and how to overcome these barriers, basic of soft skills.
Unit 2	**Non verbal Communication and Corporate Etiquettes** Body language and its different aspects, voice dynamics & voice modulation, professional appearance, clothing etiquettes and corporate dressing.
Unit 3	**Remedial Grammar and Vocabulary Building** Parts of speech, types of tense, use of articles, synonyms and antonyms, Find out the grammatical errors in the given sentences.
Unit 4	**Writing Skills and Business Correspondence** Letter writing, office documents like circulars, notices, minutes, agenda and memos. Report writings-technical report, academic report, accident report, resume writing
Unit 5	**E-Communication** Introduction to multi-cultural, global cultural traits, email communication and email etiquettes

Text and Reference Books

1. S. M. Rai and Urmila Rai, *Business Communication,* 1st ed, New York, USA, New royal book Company Publication, 2010
2. Leena Sen, *Communication skills,* 2nd Revised ed, Publisher-PHI Learning, 2007
3. William Sanborn, *Technical communication,* Delhi, Pearson publications ,2014

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4. McGraw Hills brief case books, *Presentation Skills for Managers,* United states, John A. Hill, 1888
5. Pravil S.R. Bhatia and S. Bhatia, *Professional Communication Skill,* 8th Revised ed, S. Chand Publications, 2001.
6. Daniel G. Riordan and Steven E. Pauley, *Technical Report Writing Today,* 10th ed, USA, Michael Rosenberg Publisher
7. B. N. Basu, *Technical Writing,* 1st ed, New Delhi, Prentice Hall of India,2008
8. M. A Pink and S. E. Thomas., *English Grammar Composition & Effective Business Communication,* 12th ed, S Chand Publication, 1998
9. Sarah Freeman, *Written Communication in English,* 1st ed, Orient Blackswan publication, 1996

Mapping of Course outcomes with Program outcomes:

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

1 – Low, 2 – Medium, 3 – High

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INCCC1001: Yoga		
Teaching Scheme	**Examination Scheme**	
Practicals: 04 Hrs. / Week	**ISE III**	**50 Marks**
Credits: 02		

Course Description: Yoga - In today's stressful life, there is much more need to experience relaxation and remain focused. The inner connect is very much needed to retain stability. Beyond physical exercise there is much more to do in the field of Yoga. The content of this course includes Yoga, Pranayam, Meditation, Relaxation, rejuvenation and connection with our own self. The introduction of such an experiential course helps to boost self-confidence and with regulation of mind through meditation improves concentration. Meditation is basically training of mind and helps to regulate it. Along with experiential learning, the students are also exposed to learnings contained in the supported literature.

Course Outcomes:

After completing the course students will able to

Course Outcomes	
CO1	Understand and perform Yoga Asanas
CO2	Gain knowledge about Pranayama and perform it.
CO3	Apply the concept of Mediation in everyday life and studies

List of the Experiments:

The student shall perform following experiments:

1	Perfection in at least 3 types of Yoga-asanas (Trikonasan, Konasan and Ushtrasan)
2	Perfection in at least 3 types of Pranayama (Anulom-Vilom, Bhramari and Kapalbhati)
3	Regular practice of Yoga-asanas, Pranayam and Meditation for 10 minutes during the allotted periods as per the time table and daily at home.

Text and Reference Books

1. The Heartfulness way", Heartfulness Kamlesh Patel and Joshua Pollock
2. The Yoga Sutras of Patanjali — Sri Swami Satchidananda
3. The Yamas and Niyamas — Deborah Adele
4. Yoga Practices for Anxiety and Depresion --- H. R. Nagendra & R. Nagarathana

Assessment:

The evaluation is based on participating and performing Yoga, Pranayam and meditation regularly and perfectly under the guidance by Yoga Teachers in class as per schedule. Meditation trainers will observe - intrinsic goodness, right attitude and happy and joyous way of doing things.

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MABSC1003: Mathematics – II		
Teaching Scheme	**Examination Scheme**	
Lectures: 03 Hrs. / Week	**ISE I**	**15 Marks**
Tutorial: 01 Hrs. / Week	**ISE II**	**15 Marks**
Credits: 04	**ISE III**	**10 Marks**
	End Semester Examination	**60 Marks**

Course Description: MABSC1003: Engineering Mathematics II is a compulsory course for Civil Engineering, Mechanical Engineering, Computer Science & Engineering and Information Technology students.

Course Outcomes:

After completing the course students will able to

Course Outcomes		Bloom's Taxonomy Level	Unit
CO1	Define first order first degree ordinary differential equations, orthogonal trajectories; partial derivatives, Jacobian, Directional Derivative, Gradients, Curl and divergence; Multiple integrals; Fourier Series.	K1	1,2,3,4,5
CO2	Summaries the First order First degree Linear Differential Equations; Partial, Total Derivatives; methods of solving Multiple Integrals; Fourier Series and Half Range Fourier series Expansion.	K2	1,2,3,4
CO3	Identify Order of Differential Equation and exactness; Homogeneous function, Gradient, Divergence and Curl; Even and odd functions, Euler's coefficients for the Fourier Series.	K2	1,2,4,5
CO4	Solve the First order Linear Differential Equations, Jacobians, Maxima and Minima of functions of two variables; Double and Triple Integrations; vector integration	K2	1,2,3,5
CO5	Apply knowledge of Differential equation to different Engineering Problems, Partial derivative; Multiple Integrals to find area and volume of solids; surface integral and volume integral using Green's theorem and Stoke's theorem, Fourier Series to Harmonic Analysis.	K3	1,2,3,4,5

Detailed Syllabus:

Unit 1	**First order ordinary differential equations and its applications** Exact, linear and Bernoulli's equations, application of first order ordinary differential equations: orthogonal trajectories, simple electrical circuit, D'Alembert's principle, one dimensional conduction of heat.
Unit 2	**Multivariate Calculus [Differentiation]** Limit, continuity, partial derivatives, Euler's theorem on homogeneous functions, implicit functions, composite functions, total derivatives, Jacobians and their applications, error and approximations, maxima and minima of functions of two variables, saddle points, Lagrange's method of undermined multipliers.
Unit 3	**Multiple integrals and its applications** Double and triple integrals (Cartesian and polar), change of order of integration in

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	double integrals, change of variables (Cartesian to polar), applications: to find area and volume.
Unit 4	**Fourier Series** Fourier Series (Dirichlet's conditions), Periodic functions, convergence of the Fourier series, Euler's formula, Fourier series expansion with period 2π, 2L, Fourier series of even and odd functions, Half range sine and cosine series, applications to harmonic analysis.
Unit 5	**Vector Calculus** Directional Derivative, Gradients, Curl and divergence. Vector integration: Line integral, Surface integral and volume integral, Green's Theorem, Gauss Divergence Theorem and Stoke's Theorem.

Text and Reference Books

1. Erwin Kreyszing, Advanced Engineering Mathematics,10th Edition, Mumbai: Willey Eastern Ltd. 2015.
2. B. S. Grewal, Higher Engineering Mathematics, 44th Edition, New Delhi: Khanna publication, 2017.
3. Ramana B. V. Higher Engineering Mathematics, 11th Reprint, New Delhi: Tata McGraw Hill, 2010.
4. David Poole, Linear Algebra: A Modern Introduction, 3rd Edition, USA: BROOKS/COLE CENGAGE Learning, 2011.
5. Ravish R. Singh, Mukul Bhatt, Engineering Mathematics- A tutorial approach, 4th Edition, New Delhi: Tata McGraw Hill Education Pvt. Ltd.2018.
6. Dass H.K. Advanced Engineering Mathematics, 22nd Edition, New Delhi: S. Chand publications, 2018.
7. P. N. Wartikar and J. N. Wartikar, A text book of Engineering Mathematics (Vol. 1 & 2), Reprint, Pune: Pune Vidhyarthi Griha Prakashan, 2013.

Assessment: ISEI, II, III (Class Test-1, Class Test-2, TA) & ESE

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

1. Surprise Test
2. Assignment using Mathematical tools like Mathematica/MATLAB or similar.
3. Quiz
4. Any other activity suggested by course coordinator

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I (Class Test-1)	ISE II (Class Test-2)	ISE III (TA + Surprise Test)	End Semester Examination
K1	Remember	5	5		10
K2	Understand	10	10	2	38
K3	Apply			8	12
K4	Analyze				
K5	Evaluate				
K6	Create				
Total Marks 100		15	15	10	60

Mapping of Course outcomes with Program outcomes:

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

1 – Low, 2 – Medium, 3 – High

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CHBSC1002: Battery Science, Lubricants and Green Chemistry		
Teaching Scheme	**Examination Scheme**	
Lectures: 03 Hrs. / Week	**ISE I**	**15 Marks**
Credits: 03	**ISE II**	**15 Marks**
	ISE III	**10 Marks**
	End Semester Examination	**60 Marks**

Course description: The course is mandatory course for first year B. Tech. Civil Engineering, Mechanical Engineering and Electrical Engineering programs in first semester. The course objective is to teach fundamental principles in Chemistry and relate the understanding to applications.

Course Outcomes:

After completing the course students will able to

Course Outcomes		Bloom's Taxonomy Level
CO1	To understand fundamental of Chemistry relevant to Engineering field.	K1
CO2	To differentiate between primary and secondary battery as well as battery and fuel cell.	K2
CO3	To equipped with basic knowledge of polymer reinforced composites, applications of semiconductor conducting polymers in energy harnessing.	K2
CO4	To understand Basic Principals of Green chemistry for minimizing waste.	K1
CO5	To apply the principles of water softning to hard water and understand consequence of water quality degradation.	K3

Detailed Syllabus:

	Course Contents	CO
Unit 1	**Battery Science** Introduction – Classification of batteries, Primary and secondary batteries, reserve batteries with examples, battery components and their role- Characteristics of Battery. Batteries and their importance, basic requirements for commercial batteries, construction, working and applications of Ni-Cd, and Lithium ion battery, fuel Cells- Differences between battery and fuel cell, electrical vehicle battery construction, working advantages and disadvantages of EV Car.	CO1, CO2
Unit 2	**Electrochemistry** Single electrode potential, sign convention, reversible and irreversible cells measurements, specific conductance, equivalent conductance, variation of equivalent conductance with dilution, migration of ions Nernst equation and application, determination of EMF of cell, applications of EMF series. **Chromatographic techniques** Basics and applications of chromatographic technique- thin layer chromatography, flame photometry potentiometric titrations, conductometry, PH metry	CO1, CO2

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Unit 3	**Lubricants** Introduction, mechanisms of lubrication-fluid film, boundary film & extreme pressure, types of lubricants–solid lubricants–molybdenum disulphide, graphite. Liquid lubricants– vegetable, animal, mineral & synthetic oils, semisolid lubricants, greases, lubricating emulsions– oil in water, Water in oil, properties of lubricants & its significance– physical properties and significances viscosity & viscosity index, flash & fire point, cloud & pour point, acid value, saponification value, steam emulsification number **Conducting Polymers:** Definition- classification- intrinsic and extrinsic, mechanism of conduction in doped poly acetylene -applications synthesis & mechanism of conduction in poly-acetylene **Composites:** Basics of composites, Composition and Characteristic properties of composites. Types of Composites: Particle, Fiber, Reinforced, Structural, applications. **Nano materials:** Introduction, fullerenes, carbon nano tubes, nano wires, electronic and mechanical properties, synthesis of nano materials, applications of nano materials-Catalysis, Electronics & Telecommunication, Medicines, Energy sciences.	CO1, CO3
Unit 4	**Energy sciences & Green Chemistry:** **Green Chemistry:** Introduction- definition of green chemistry, need of green chemistry, basic principles of green 12 principles of green chemistry principles of green chemistry, waste minimization and atom economy, reduction of materials and energy requirement, significance, concept of sustainability, industrial applications of green chemistry **Fuels:** Fuel- classification, characteristics of good fuel, comparison between solid, liquid, gaseous fuel, alternative and non conventional fuels, calorific value, low and high calorific value, units of calorific value, determination of calorific value by Bomb calorimeter, fuel cells, solar cell and polymer cell, hydrogen-oxygen fuel cell, advantages and applications.	CO1, CO4
Unit 5	**Water treatment:** Introduction, sources and impurities in water, portable water; meaning and specifications (WHO standards), hardness of water types, determination of hardness using EDTA titration and numerical, softening of hard water by ion-exchange process. numerical problems on hardness of water, biological oxygen demand (BOD) and chemical oxygen demand (COD), determination of COD of industrial waste water, purification of water for town supply, principal wastage treatment – industrial waste water	CO1, CO5

Text and Reference Books

1. F. W. Billmeyer, Text Book of Polymer Science, John Wiley & Sons, 15th Edition, 2020.
2. B. K. Sharma- A text book of Industrial Chemistry. 15th Edition, 2020. G.A. Ozin & A.C. Arsenault, “Nanotechnology A Chemical Approach to Nanomaterials”. RSC Publishing, 5th Edition, 2020.
3. Uppal M.M, Jain and Jain. Engineering Chemistry, Khanna Publishers, 45th Edition, 2020.
4. P.C. Jain and Monica Jain, A test Book of Engineering Chemistry, Dhanpat Rai Publications, New Delhi, 20th Edition, 2020.

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5. S. S. Dara -A Text book of Engineering Chemistry, S Chand & Company Ltd., 15th Edition, 2020.

Mapping of Course outcomes with Program outcomes:

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

1 – Low, 2 – Medium, 3 – High

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CHBSC1003: Lab Chemistry		
Teaching Scheme	**Examination Scheme**	
Practical: 02 Hrs / Week	**ISE III**	**25 Marks**
Credit: 01		

Course Outcomes:

After completing the course students will able to

Course Outcomes	
CO1	Perform qualitative and quantitative determination of physical and chemical properties of lubricants, polymers and water used for domestic and industrial application.
CO2	Explain the objectives of experiments, perform the experiments, appropriately record the data and analyze the results with accuracy and precision.
CO3	Demonstrate laboratory skills by use of relevant instrument or modern analytical methods for analysis of chemical compounds.
CO4	Work effectively and safely in a laboratory environment in teams as well as independently.
CO5	Recognize the issues of safety regulations, ethical, societal, economical and environmental issues in the use of chemicals in their laboratory work.

List of the Experiments:

The student shall perform any eight experiments of the following:

Sr. No.	Title of the Experiments	Skill / Knowledge Level	CO
1	Determination of hardness of water by EDTA method.	S3/K2	CO3, CO4, CO2
2	Determination of BOD and COD of water sample	S3/K2	CO3, CO5, CO2
3	Determination of Cell Constant.	S3/K2	CO3, CO2
4	Determination of Acid Value of lubricant.	S1/K1	CO1, CO5, CO2
5	Determination of chloride content of water by Mohr's method	S1/K1	CO1, CO5, CO2
6	Determination of Viscosity of lubricating oils by Redwood Viscometer.	S3/K2	CO3, CO4, CO2
7	Determination of Flash & Fire point of lubricant oil.	S3/K2	CO3, CO4, CO2
8	To Determination P^H value of solutions by indicator, Paper and by P^H meter	S1/K1	CO3, CO5, CO2
9	Preparation of Phenol Formaldehyde Resin (Bakelite) /Urea formaldehyde resin.	S2/K2	CO2, CO4, CO5
10	Determination of Iron by colorimetric method.	S3/K2	CO3, CO2
11	Separation of chemicals by thin layer chromatography.	S2/K2	CO3, CO2
12	Dermination of strength of acids by Potentiometric titrations	S2/K2	CO1, CO4, CO5, CO2
13	Determination of Cloud & Pour point of lubricant oil.	S3/K2	CO3, CO2
14	To verify Lambert Beer's Law calorimetrically.	S3/K2	CO3, CO2
15	To determine Rf value and identify phenyl alanine &	S3/K2	CO3, CO2

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	Glycine mixture by ascending paper chromatography.		
16	Demonstration Of TLC/Paper chromatography	S2/K2	CO3, CO2
17	To determine conduct metrically, the strength of given HCl solution by titrating with standard NaOH solution.	S3/K2	CO3, CO2
18	To determine the empirical formula of ferric-5 sulpho salicylate complex by Jobs method.	S3/K2	CO3, CO2

Mapping of Course outcomes with Program outcomes:

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

1 – Low, 2 – Medium, 3 – High

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AMESC1001: Engineering Mechanics		
Teaching Scheme	**Examination Scheme**	
Lectures: 03 Hrs / Week	**ISE I**	**15 Marks**
Credits: 03	**ISE II**	**15 Marks**
	ISE III	**10 Marks**
	End Semester Examination	**60 Marks**

Prerequisites: Knowledge of vectors and scalars and preliminary knowledge of motion.

Course Description: Engineering Mechanics is one of the basic subjects for the students of engineering, irrespective of their branches, since it helps them to develop the logical thinking, analytical ability and enhance the imagination power. It introduces the students to various types of forces, their resultant, equilibrium of forces, analysis of various force system and the effect of forces on the state of motion of the body. Students will be exposed to C.G. and M.I. of the area and mass M.I. of the bodies. They will also be exposed to dynamics of particle and rigid body.

Course Outcomes:

After completing the course students will able to

Course Outcomes	
CO1	State and explain the relevant laws of statics and dynamics.
CO2	Determine resultant, identify the force system acting on bodies and perform static analysis of a given system.
CO3	Determine the member forces of a truss. Determine the centroid and compute moment of inertia of area and center of gravity and mass moment of inertia of regular bodies.
CO4	Establish relations between kinematic parameters for different types of motion and compute the motion characteristics.
CO5	Apply the principles of kinetics to compute the motion parameters or related forces of a given system.

Detailed Syllabus:

Unit 1	**Fundamental Concepts, Forces and their Resultant:** Fundamental Concepts and Principles, Types of Force systems, Composition and Resolution of Forces, Moment of force, Couple, Resultant of Planar and Spatial force systems, Analytical and Graphical methods.
Unit 2	**Equilibrium of Forces and Friction:** Free body diagrams, Equations of Equilibrium, Types of Supports and support reactions, Equilibrium of Co-planer force systems, Applications to beams and frames, Equilibrium of non-coplanar concurrent force systems. Theory and Laws of Friction, Cone of friction, wedge friction, rolling friction, Belt friction and their applications.
Unit 3	**C.G. and M.I. of Plane Sections and Regular Bodies:** Centroid of Plane figures and lines, Moment of Inertia of plane sections, Transformation theorems, Radius of gyration, Centre of gravity and Mass Moment of Inertia of regular bodies.
Unit 4	**Kinematics of particles:** Rectilinear Motion, Equations of Motion, Motion curves and their applications, Curvilinear motion in Cartesian and Polar coordinates, Motion of projectile, Relative motion, Fixed axis rotation.
Unit 5	**Kinetics of particles:** Newton's laws of Motion, D'Alembert's Principle, Equations of motion of particle and rigid body, motion of connected bodies, Fixed axis rotation.

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	Principle of work and Energy, Principle of Impulse and Momentum and their applications to particles, Direct central impact.

Text and Reference Books

1. Beer and Johnston, Mechanics for Engineers (Statics and Dynamics), McGraw Hill Co. Ltd.
2. A. K. Tayal, Engineering Mechanics, Umesh publications.
3. V. S. Mokashi Engineering Mechanics Vol. I and II, Tata McGraw Hill Publishing Co. Ltd., New Delhi.
4. S. S. Bhavikutti and K.G. Rajashekarappa, Engineering Mechanics, New Age International (P) Limited Publishers, New Delhi.
5. F. L. Singer, Engineering Mechanics, Harper and Row Publishers, USA
6. Timoshenko and Young, Engineering Mechanics, McGraw Hill Co. Ltd.
7. R. C. Hibbeler, Engineering Mechanics (Statics and Dynamics), McMillan publications
8. McLean and Nelson, Engineering Mechanics, Schaum's Outline Series, McGraw Hill Co. Ltd. New Delhi

Assessment: 1) For assessment under ISE-I and ISE-II, two test of 15 marks each, Test-I and Test-II, will be conducted on prescribed syllabus (around first 1.5 to 2 Units for Test-I and 3rd and some portion of 4th Unit for Test-II).

2) Under ISE-III- Teachers Assessment of 10 marks may be based on one or more of the following

i. Technical quizzes.
ii. Assignments-Numerical solution.
iii. Punctuality.

Assessment Pattern:

Assessment Pattern Level No.	**Knowledge Level**	**ISE I**	**ISE II**	**ISE III**	**End Semester Examination**
K1	Remember	02	02		06
K2	Understand	03	03	02	10
K3	Apply	10	10	08	44
K4	Analyze				
K5	Evaluate				
K6	Create				
Total Marks 100		15	15	10	60

Assessment table:

Assessment Tool	K1, K2	K3	K2, K3	K3	K3
	CO1	CO2	CO3	CO4	CO5
ISE I (15 Marks)	05	10	-	-	-
ISE II (15 Marks)	02		09	04	
ISE III (10 Marks)	02	02	02	02	02
ESE Assessment (60 Marks)	12	12	12	12	12
Total Marks 100	21	24	23	18	14

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Mapping of Course outcomes with Program outcomes:

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

1 – Low, 2 – Medium, 3 – High

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AMESC1003: Lab Engineering Mechanics		
Teaching Scheme	**Examination Scheme**	
Practical: 02 Hrs / Week	**ISE III**	**25 Marks**
Credit: 01		

Course Outcomes:

After completing the course students will able to

Course Outcomes	
CO1	Apply graphical method to solve problems of statics.
CO2	Demonstrate the principles of Engineering Mechanics experimentally and interpret the experimental results.
CO3	Solve numerical examples in statics and dynamics.

List of the Experiments:

The student shall use graphical method to solve the problems of engineering mechanics (Sr. No. 1) and perform the experiments given below. They should also complete the tutorial problems of the subject Engineering Mechanics given by the teacher as a part of laboratory work.

Sr. No.	Title of the Experiments	Skill / Knowledge Level	CO	Marks for ISE
1	Graphical solutions for the following problems a. Resultant of Coplanar Non-Concurrent force system: i. At least one problem with resultant as a force ii. At least one problem with resultant as a couple b. Equilibrium of Coplanar Non-Concurrent force system: At least one Problem c. Friction: At least one Problem	K2, K3	CO1	
2	Following experiments shall be conducted., a. Polygon law of forces b. Law of moments c. Jib crane d. Beam reaction e. Friction f. Screw jack g. Fly wheel	Kl, K2, K3	CO2	
3	Tutorial Problems a. At least three problems on each unit of the theory course of Engineering Mechanics. b. The tutorial problem needs to be solved by the student during the practical hours only.	K1, K2, K3	C03	

Assessment: ISE-III: Assessment will be based on understanding of theory/experiment, the performance of practical, completion of term work, completion of tutorial problems, participation in group activity etc.

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Assessment Pattern:

Assessment Pattern Level No.	**Knowledge Level**	**ISE III**
K1	Remember	05
K2	Understand	10
K3	Apply	10
K4	Analyze	-
K5	Evaluate	-
K6	Create	-
Total Marks		25

Mapping of Course outcomes with Program outcomes:

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

1 – Low, 2 – Medium, 3 – High

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MEESC1003: Design Thinking		
Teaching Scheme	**Examination Scheme**	
Lectures: 02 Hrs / Week	**ISE I**	**10 Marks**
Credits: 02	**ISE II**	**10 Marks**
	End Semester Examination	**30 Marks**

Course Objectives:

1. To Understand the concepts of design thinking approaches
2. To Create design thinking teams and conduct design thinking sessions
3. To provide a social and thinking space for the recognition of innovation challenges and the design of creative solutions.
4. To propose a concrete, feasible, viable and relevant innovation project/challenge

Course Outcomes:

After completing the course students will able to

Course Outcomes	
CO1	Describe design thinking process
CO2	Explain stages of design thinking
CO3	Interpret different inventive problem-solving theories
CO4	Apply prototype development process for a product

Detailed Syllabus:

Unit 1	**Overview of Design Thinking Process:** Understanding the Learning Process, Kolb's Learning Styles, Assessing and Interpreting, Design Thinking Process: Business context of innovation for applying design thinking, two models of design thinking, phases of design thinking.	**CO1**
Unit 2	**Design thinking and its approaches:** Definition of Design Thinking, Need for Design Thinking, Objective of Design Thinking, Origin of design thinking, understanding design thinking and its process model, Human-Centered Design (HCD) process - Empathize, Define, Ideate, Prototype and Test and Iterate or Empathize, Analyze, Solve and Test.	**CO2**
Unit 3	**Analyze or Define** Root cause analysis, conflict of interest, perspective analysis, big picture thinking through system operator, big picture thinking through function modelling Silent brainstorming, metaphors for ideation, CREATE and What-If tool for ideation, introduction to TRIZ, Inventive principles and their applications	**CO3**
Unit 4	**Test (Prototyping and Validation)** What is Prototype? Why Prototype? Rapid Prototype Development process, Testing, Sample Example, Test Group Marketing Prototyping, Assumptions during the design thinking process, Validation in the market, best practices of presentation. (Only procedure of validation to be taught)	**CO4**

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Text and Reference Books

1. Bala Ramadurai, “Karmic Design Thinking”, First Edition, 2020.
2. E. Balaguruswamy, “Developing Thinking Skills (The way to Success)”, Khanna Book Publishing Company, (2022).
3. Vijay Kumar,”101 "Design Methods: A Structured Approach for Driving Innovation in Your Organization”.
4. IDEO ,”Human-Centered Design Toolkit: An Open-Source Toolkit to Inspire New Solutions in the Developing World”, IDEO 2011.
5. Marc Stickdorn and Jakob Schneider,” This is Service Design Thinking: Basics, Tools, Cases”, BIS Publishers,2014.
6. Ulrich, Karl T. Design: Creation of artifacts in society, 2011.
7. Tim Brown “Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation”, Harper Collins, 2009.

Useful Links

1. https://onlinecourses.nptel.ac.in/noc22_mg32/preview By Prof. Bala Ramadurai/ IIT Madras
2. https://youtu.be/4nTh3AP6knM
3. https://www.tutorialspoint.com/design_thinking/design_thinking_introduction.htm

Mapping of Course outcomes with Program outcomes:

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

1 – Low, 2 – Medium, 3 – High

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MEESC1004: Lab Design Thinking		
Teaching Scheme	**Examination Scheme**	
Practical: 02 Hrs / Week	**ISE III**	**25 Marks**
Credit: 01		

Course Outcomes:

After completing the course students will able to

Course Outcomes	
CO1	Compare various design thinking stages
CO2	Recognize new ways of creative thinking, innovation cycle of Design Thinking process for developing innovative products.
CO3	Prepare empathy map and journey map for product design
CO4	Apply innovative theories for creating new prototypes products

List of the Experiments:

Students has to perform Minimum Six Experiments out of the given list

Sr. No.	Title of the Experiments	CO
1	Understanding of Design Thinking and its process model, Principles, and tools. (Activity: Design a mind map for processes of design thinking).	CO1
2	How to Empathize, Role of Empathy in design thinking, Empathy Maps Design. (Activity: Construct empathy maps to provide right solution to any challenges through interviews, GD, observations, and other sources).	CO1
3	Methods for Empathetic Design, Creation of User Personas. (Activity: Construct Persona profile which includes user information).	CO2, CO3
4	Customer Journey Mapping (Activity**:** Develop customer journey map to provide a roadmap visual of customers experience).	CO3
5	Problem clarification, Understanding of the problem. (Activity: Construct worksheet for customer journey map to select best route).	CO1
6	Problem analysis and Reformulation of the problem. (Activity: Generate summarized report for customer journey map).	CO2
7	Case Study - students can pick one idea from their brainstorm list and use the "Sketch Prototype Worksheet" to sketch out their solution for their classmate.	CO2
8	Root Causes Analysis, Conflict of Interest, Description of customer need.	CO4
9	Design Cash Flow Diagram and Value Chain Analysis Diagram for weekly expenditure of person. (Case Study)	CO2
10	Apply the iterations in design thinking process and create prototype	CO4

Mapping of Course outcomes with Program outcomes:

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

1 – Low, 2 – Medium, 3 – High

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MEPCC1001: Basics of Mechanical Engineering		
Teaching Scheme	**Examination Scheme**	
Lectures: 02 Hrs / Week	**ISE I**	**10 Marks**
Credits: 02	**ISE II**	**10 Marks**
	End Semester Examination	**30 Marks**

Course Description: After completing this course student will have a fundamental understanding of the thermodynamics, thermal machine source of energy, power transmission elements, identify manufacturing process and machines

Course Outcomes:

After completing the course students will able to

Course Outcomes	
CO1	Explain basic concepts to be used in Mechanical Engineering
CO2	Apply the principles of thermodynamics to solve numerical problems
CO3	Compare the working principles of Energy conversion devices with their application in Mechanical Engineering
CO4	Explain the working principles and basic operating safety procedures of various transmission elements employed in Mechanical Engineering.

Detailed Syllabus:

Unit 1	**Fundamentals of Thermodynamics** Pressure and pressure measurement, Temperature, Forms of energy, work transfer, heat transfer, Laws of thermodynamics, First law for cyclic and non-cyclic process, Concept of Heat Engine, Heat pump, Statement and explanation of Fourier's law of heat conduction, Overall heat transfer coefficient, Newton's law of cooling, Stefan Boltzmann's law, Concept of heat exchanger, types of heat exchanger, and concept of effectiveness.
Unit 2	**Energy Conversion Devices** Steam generation process, Boiler: Mountings and accessories, working principles of Internal combustion Engine, two stoke and four stroke engines, Refrigeration – Definitions – Refrigerating effect, Ton of Refrigeration, COP, Relative COP, unit of Refrigeration, Refrigerator. Principle and working of vapor compression refrigeration Principles and working of steam power plant and nuclear power plant.
Unit 3	**Fundamentals of Power Transmitting Elements and Mechanism** Working principles of shaft, Axle and Spindles. Friction clutches, Brakes – types of brakes, Couplings-types of couplings, Bearing- types of bearing, Drives- Belt drive: Flat and V belt drive, Open and Cross belt drive, Chain drive, Gears- classification of gears, Simple mechanism: Slider crank mechanism, Pendulum pump, Oscillating cylinder engine, Whitworth quick return mechanism
Unit 4	**Fundamentals of Manufacturing Process** Fundamentals of manufacturing process and their application, Casting, forging, soldering, Brazing and welding. Differences between soldering, brazing and Welding. Description of Electric Arc Welding and Oxy-Acetylene Welding, Adhesives.

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Text and Reference Books

1. Nag P.K., *"Engineering Thermodynamics",* 3rd ed. Tata-McGraw Hill Publications, 2013.
2. Rajput R.K., *"Engineering Thermodynamics",* 4th ed. Laxmi Publications, 2014.
3. Hajra Choudhary, Bose, *"Work Shop Technology* (Vol.-I &JI)", 3rd ed. MPP publication, 2018.
4. Bhandari V.B., *"Machine Design ",* 3rd ed. Tata-McGraw Hill Publications, 2019.
5. Khurmi R.S., *"Machine Design* ",4th Edition. Eurasia Publishing House, 2019.
6. Domkundwar V.M. *"Engineering Thermodynamics",* 4th ed. Dhanpat Rai Publication, 2020.
7. Rao P.N, *"Manufacturing Technology* Volume J", 3rd ed. Tata-McGraw Hill Publications, 2019
8. Holman J. P., "Heat transfer", McGraw Hill Publishing, New York

Mapping of Course outcomes with Program outcomes:

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

1 – Low, 2 – Medium, 3 – High

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MEVSE1001: Workshop Practice - I		
Teaching Scheme	**Examination Scheme**	
Practical: 04 Hrs / Week	**ISE III**	**50 Marks**
Credit: 02		

Course Description: Objective of this course is to provide an insight and inculcate the essentials of workshop to the students of Mechanical Engineering discipline and to provide the students an illustration of the significance of the workshop practices. In this course the students will have to prepare jobs as mentioned in the curriculum.

Course Outcomes:

After completing the course students will able to

Course Outcomes	
CO1	Explain various basic tools and measuring instruments used in workshop trades along with safety practices
CO2	Operate various measuring instruments and tools used in carpentry, fitting, plumbing
CO3	Practice hands-on exercises on carpentry, fitting, plumbing trade to improve the knowledge and the skill sets.
CO4	Explain power tools used in Carpentry, Fitting, plumbing with required safety measures.

List of the Experiments:

Sr. No.	Title of the Experiments
1	Introduction – Safety, Basics tools, measuring instruments used in workshop, different subsections, information of lathe CNC, universal wood working machine, welding etc.
2	Plumbing - Basic tools, work holding devices, marking tools, measuring tools, cutting tools, finishing tools, one job consisting of PVC and UPVC items and one job of external threading
3	Fitting – Basic tools, power saws, work holding devices, marking tools, measuring tools, cutting tools, finishing tools, various operations, safe work practices, power tools. One job per student on blanking, drilling, fitting involving sawing and marking
4	Carpentry - Basic tools, work holding devices, marking tools, measuring tools, cutting tools, finishing tools, various operations on wood working lathe, power tools and safe work practices. Fabrication of one job per student involving planning, cutting, drilling, surface finishing etc.
5	One group project on plumbing and fitting for a team consisting of maximum 04 students or any other value-added project consisting of engineering manufacturing
6	One group project on carpentry for a team consisting of maximum 04 students or any other value-added project consisting of engineering manufacturing
7	Electrical and electronics measuring devices such as multimeter, Oscilloscope etc
8	Electrical circuit making on a board
9	Use of breadboard

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Mapping of Course outcomes with Program outcomes:

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

1 – Low, 2 – Medium, 3 – High

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MEIKS1001: Indian Metallurgy		
Teaching Scheme	**Examination Scheme**	
Lectures: 02 Hrs / Week	**ISE I**	**10 Marks**
Credits: 02	**ISE II**	**10 Marks**
	End Semester Examination	**30 Marks**

Course Description: Engineering student should be conversant with the ferrous and nonferrous engineering materials. This course will give the student a feel of the associated properties of the product being studied. This course aims at developing an attitude of the student and preparing a basement for dealing with various properties and application of various materials.

Course Outcomes:

After completing the course students will able to

Course Outcomes	
CO1	Understand the ancient concept of metal making
CO2	Gain knowledge about ancient and pre modern mining and manufacturing
CO3	Gain knowledge about the Indian iron and steel

Detailed Syllabus:

Unit 1	Vedic references to metals and metal working. Mining and manufacture in India of Zinc, Iron, Copper, Gold, etc., from ancient times. Indian texts which refer to metallurgy.
Unit 2	Important specimens of metal workmanship preserved/found in different parts of India. The significance and wide prevalence of ironsmith and other metal workers in the pre-modern era.
Unit 3	European observers on the high quality and quantity of Indian iron and steel in the 18/19th centuries.

Text and Reference Books

1. Ancient Indian Metallurgy: Theory and Practice, Ashoka K. Mishra, 2009
2. Mining and Metallurgy in Ancient India, Rina Shrivastava.
3. A History of Metallurgy in India, Gurprit Singh
4. Ancient Indian Metallurgy, Ashoka Kumar Mishra
5. Introduction to the Thermodynamics of Materials by David R. Gaskell
6. Materials Science and Engineering by Raghavan V

Assessment:

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

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

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Assessment Pattern:

Assessment Pattern LevelNo.	KnowledgeLevel	ISE I	ISE II	ISE III TA	End Semester Examination
K1	Remember	3	3		6
K2	Understand	3	3		6
K3	Apply	4	4		12
K4	Analyze				6
K5	Evaluate				
K6	Create				
Total Marks 50		10	10	0	30

Assessment table:

Assessment Tool	K1, K3	K2, K3	K3, K4
	CO1	CO2	CO3
ISE I (10 Marks)	5	5	
ISE II (10 Marks)		5	5
ESE Assessment (30 Marks)	10	10	10
Total Marks 50	15	20	15

Mapping of Course outcomes with Program outcomes:

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

1 – Low, 2 – Medium, 3 – High

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INCCC1002: NSS / INCCC1003: Sports / INCCC1004: Club Activities		
Teaching Scheme	**Examination Scheme**	
Practicals: 04 Hrs. / Week	**ISE III**	**50 Marks**
Credits: 02		

Course Description: Co-curricular activities are activities that take place outside of a course's curriculum but are related to academics in some way. Although involvement is not part of classroom instruction, it does supplement and enhance a student's academic experience.

NSS: Aim of NSS activities to Gain skills in mobilizing community participation; To acquire leadership qualities and democratic attitude; To develop the capacity to meet emergencies and national disasters; To practice national integration and social harmony. Types of Activities are not limited to Cleaning, Plantation, Blood Donation Camps, Awareness Rallies, Health Care Camps, Stage shows or a procession creating awareness of such issues as social problems, education and cleanliness but decided by Institute NSS Coordinator. Students will participate in NSS Activities throughout semester.

The evaluation is based on participation in regular NSS activities. NSS Coordinator along with departmental NSS coordinator will certify at the end of semester about participation. Program head will notify the exam section about awarding credits to the students.

Sports activity: Sporting Activities means performing or participating in the Sport in any capacity which includes, but is not limited to, participation in training, competitions, coaching or as an official.
Students will participate in Sports Activities throughout semester. Gymkhana vice president will coordinate along with sports coordinator of department. The coordinators will certify at the end of semester about participation. Program head will notify the examination section about awarding credits to the students. The evaluation is based on participation in regular sports activities.

Club activities: Government Engineering College Aurangabad has various clubs that focus on specific interests such as robotics, coding, literature, environment, etc. These clubs often organize events, workshops, and competitions that provide students with opportunities to learn new skills and showcase their talents. Students will participate in Club Activities throughout semester. Faculty coordinators will coordinate along with students bodies the activities of club.

The faculty coordinators will certify at the end of semester about participation of students. Program head will notify the examination section about awarding credits to the students.

Dean Students affairs and all program heads will formulate additional modalities for smooth conduction of cocurricular activities as and when required.

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MEINT1001: Internship		
Teaching Scheme	**Examination Scheme**	
Practical: 16 Hrs / Week	**ISE III**	**100 Marks**
Credit: 08	**End Semester Examination**	**100 Marks**

Course Objectives:

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

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

Course Outcomes:

After completing the course students will able to

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

Guidelines:

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

Duration:

The internship shall have 08 credits, minimum 16 hours per week interaction for a duration of 02 months.

Internship work Identification:

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

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

Internship work identification process should be initiated before the end of IInd semester in case of Exit criteria of First Year B. Tech. program in coordination with training and

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

Internship Diary/ Internship Workbook:

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

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

Internship Work Evaluation:

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

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

Feedback from internship supervisor (External and Internal)

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

Mapping of Course outcomes with Program outcomes:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1			1								
CO2		1	1									
CO3				1								

1 – Low, 2 – Medium, 3 – High

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MEVSE1002: Computer Aided Drafting and Modeling		
Teaching Scheme	**Examination Scheme**	
Practical: 08 Hrs / Week	**ISE III**	**50 Marks**
Credit: 04	**End Semester Examination**	**50 Marks**

Course Description: The market driven economy demands frequent changes in product design to suit the customer's needs. With the introduction of computers, the task of modeling any complex part and incorporating frequent changes as per customer requirement are becoming simpler. Moreover, the technology driven competitive environment in today's market is compelling design/consulting engineering firms and manufacturing companies to seek CAD conversion of their existing paper-based engineering documents. The focus of this course is to provide the student with hands-on experience in drafting and editing of an industrial production drawing and making them competent in latest solid modeling and assembly practices.

Course Outcomes:

After completing the course students will able to

Course Outcomes	
CO1	Understand the CAD workspace and interface: Students will familiarize themselves with the different components of CAD software, such as toolbars, menus, and workspace layouts, gaining proficiency in navigating and using essential drawing tools.
CO2	Create 2D drawings: Students will learn to draw and modify 2D entities, including lines, arcs, circles, and polygons, employing precision techniques for accurate and detailed representations.
CO3	Dimensioning and annotation: Students will develop skills in adding dimensions and text annotations to their 2D drawings, enhancing clarity and communicative value in technical documentation.
CO4	Master 3D modelling: Students will delve into the principles of 3D modeling, employing extrusion, lofting, and revolving techniques to create intricate 3D models of objects and structures.
CO5	Assemble and present: Students will assemble multiple 3D models to create assembly drawings, applying constraints and mates to simulate real-world relationships and produce exploded views and section views for enhanced visual representation.

Underpinning Theory Components: The following topics/subtopics should be taught and assessed in order to achieving the COs to attain the identified competency.

Unit 1	**Fundamentals of Computer Aided Drafting** Fundamentals of Computer Aided Drafting (CAD) and its applications, Various Software for Computer Aided Drafting. Co-ordinate System- Cartesian and Polar Absolute, Relative mode, UCS, WCS. CAD initial setting commands - Snap, grid, Ortho, Osnap, Limits, Units, scale, Object tracking etc. Object Selection methods - picking, window, crossing, fence, last and previous. Open, save and close a new and existing drawing/template.
Unit 2	**Draw and Modify Commands** Zoom Commands - all, previous, in, out, extent, Realtime, dynamic, window, pan etc; Formatting commands - linetype, lineweight, color. Draw Command - Line, arc, circle, rectangle, polygon, ellipse, spline, block, hatch etc;

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	Modify Command - Erase, trim, extend, copy, move, mirror, offset, fillet, chamfer, array, rotate scale, lengthen, stretch, breaks divide, explode and align. Grips editing - Move, Copy, Stretch.
Unit 3	**Dimensioning, Text and Plot Commands** Dimensioning commands – Create & modify Dimension styles, Dimensional Tolerances and geometrical Tolerances. Text commands - dtext. mtext command. Plotting a drawing - paper space, model space, creating table. Plot commands.
Unit 4	**Working in 2D environment** Introduction, features and applications of different software packages used for solid modeling. System requirement & compatibility with other software. Working in Sketcher mode - Line, Profile, Circle, Arc, curves, Rectangle and their sub options. Constraints – Dimensioning constraint, Geometrical constraint.
Unit 5	**Part Modeling** Working in 3D environment - Creating reference plane, creating 3D solid models of simple machine parts. 3D Commands - Extrude, Revolve, Sweep, Pattern, Draft, loft and Blend or similar commands. Intersection of solids - Intersect two solid components by inserting new body option.
Unit 6	**Assembly, Drafting & Plotting** Assembly Drawing - Introduction to top down and bottom-up approach of assembly. Preparation of assembly drawing by using assembly features. Exploded view - Explode the assembly. Working in Drafting mode – Generate orthographic projections i.e., front view, top view, side view, sectional views, isometric views, auxiliary views. Dimensioning commands – Apply dimensions, dimensional and geometrical tolerances. Bill of material - Prepare part list table and name plate. Page set up. Plot command.

List of the Experiments:

Sr. No.	Title of the Experiments
1	Use customization tool bar of CAD software to customize main window and to do interfacing.
2	Prepare a template of your institute.
3	Draw given 2D entities (any two) individually using draw commands.
4	Draw given 2D entities (any two) and modify them individually using draw and edit commands.
5	Draw given views of hexagonal nut and Bolt (similar objects can be taken up) using Computer Aided Drafting software.
6	Draw given views of V-Groove Pulley, 2-Wheeler Piston (similar objects can be taken up) using Computer Aided Drafting software
7	Draw given views of Open-ended spanner, Deep groove ball bearing (similar objects can be taken up) using Computer Aided Drafting software.
8	Draw given views of flange coupling, universal coupling (similar objects can be taken up) using Computer Aided Drafting software.

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9	Dimension the above drawings created in experiment No. 3 to 8.
10	Make blocks of hexagonal nut and bolt, Ball bearing and insert
11	Print any three drawings from above list along with the template of institute prepared.
12	Customize main window and interface of the 3D modeling software using customization tool bar.
13	Draw given 2D drawing using various draw commands. (Any two).
14	Apply geometrical and dimensional constraints to the drawing drawn in experiment No. 13
15	Draw given 2D complex drawing using various draw, edit, modify and dimension commands. (Any two)
16	Apply geometrical and dimensional constraints to the drawing drawn in experiment No. 15.
17	Create given part models using commands like Extrude, Revolve, Shell etc;
18	Create a given part using extrude and revolve feature like muff coupling, shaft etc;
19	Create given part models using commands like Mirror, Chamfer, Fillet, Rib, Pattern etc;
20	Develop given simple part models of Cotter joint and flange coupling.
21	Create a given simple part using commands like Sweep, Blend, Draft and loft or similar commands.
22	Develop given part models of machine vice, tool post or Universal coupling.
23	Develop complex part model of screw jack.
24	Apply assembly constraints like mate, align, insert in the given drawing.
25	Develop any one assembly from part models prepared in experiment no. 18 or 20. Apply assembly constraints.
26	Develop any one assembly from given part models prepared in experiment No. 22 or 23. Apply assembly constraints.
27	Create exploded view of the given assemblies.
28	Create a part drawing using drafting mode.
29	Generate orthographic views of prepared solid model part. Apply important dimensions.
30	Generate sectional views of solid model.
31	Generate orthographic views of prepared solid model assembly and prepare bill of material.
32	(a) Plot part drawing on A4 (Any one) (b) Plot assembly drawing on A3 (Any one)

Mapping of Course outcomes with Program outcomes:

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

1 – Low, 2 – Medium, 3 – High

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MEVSE1003: Programming and Problem Solving		
Teaching Scheme	**Examination Scheme**	
Practical: 08 Hrs / Week	**ISE III**	**50 Marks**
Credit: 04	**End Semester Examination**	**50 Marks**

Course Objectives: Prime objective is to give students a basic introduction to programming and problem solving with computer language Python. And to introduce students not merely to the coding of computer programs, but to computational thinking, the methodology of computer programming, and the principles of good program design including modularity and encapsulation.

1. To understand problem-solving, problem-solving aspects, programming and to know about various program design tools.
2. To learn problem solving with computers
3. To learn basics, features and future of Python programming.
4. To acquaint with data types, input output statements, decision making, looping and functions in Python
5. To learn features of Object-Oriented Programming using Python
6. To acquaint with the use and benefits of files handling in Python

Course Outcomes:

After completing the course students will able to

Course Outcomes	
CO1	Inculcate and apply various skills in problem solving.
CO2	Choose most appropriate programming constructs and features to solve the problems in diversified domains.
CO3	Exhibit the programming skills for the problems those require the writing of well documented programs including use of the logical constructs of language, Python.
CO4	Demonstrate significant experience with the Python program development environment.

Guidelines for Student's Lab Journal

The laboratory assignments are to be submitted by student in the form of journal. Journal consists of prologue, Certificate, table of contents, and handwritten write-up of each assignment (Title, Objectives, Problem Statement, Outcomes, software & Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory-Concept in brief, features of tool/framework/language used, Design, test cases, conclusion. Program codes with sample output of all performed assignments are to be submitted as softcopy.

As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of write-ups and program listing to journal may be avoided. Use of DVD containing students' programs maintained by lab In-charge is highly encouraged. For reference one or two journals may be maintained with program prints at Laboratory. **Use of open-source software and recent version is to be encouraged**. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness.

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List of the Experiments:

Students has to perform any 18 experiments from the following list.

Sr. No.	Write Program in Python (with function/class/file, as applicable)
1	To calculate salary of an employee given his basic pay (take as input from user). Calculate gross salary of employee. Let HRA be 10 % of basic pay and TA be 5% of basic pay. Let employee pay professional tax as 2% of total salary. Calculate net salary payable after deductions.
2	To accept an object mass in kilograms and velocity in meters per second and display its momentum. Momentum is calculated as $e=mc^2$ where m is the mass of the object and c is its velocity.
3	To accept N numbers from user. Compute and display maximum in list, minimum in list, sum and average of numbers.
4	To accept student's five courses' marks and compute his/her result. Student is passing if he/she scores marks equal to and above 40 in each course. If student scores aggregate greater than 75%, then the grade is distinction. If aggregate is 60>= and <75 then the grade if first division. If aggregate is 50>= and <60, then the grade is second division. If aggregate is 40>= and <50, then the grade is third division.
5	To check whether input number is Armstrong number or not. An Armstrong number is an integer with three digits such that the sum of the cubes of its digits is equal to the number itself. Ex. 371.
6	To simulate simple calculator that performs basic tasks such as addition, subtraction, multiplication and division with special operations like computing x^y and x!
7	To accept the number and Compute a) square root of number, b) Square of number, c) Cube of number d) check for prime, d) factorial of number e) prime factors
8	To accept two numbers from user and compute smallest divisor and Greatest Common Divisor of these two numbers.
9	To accept a number from user and print digits of number in a reverse order.
10	To input binary number from user and convert it into decimal number.
11	To generate pseudo random numbers.
12	To accept list of N integers and partition list into two sub lists even and odd numbers.
13	To accept the number of terms a find the sum of *sine* series.
14	To accept from user the number of Fibonacci numbers to be generated and print the Fibonacci series.
15	Write a python program that accepts a string from user and perform following string operations- i. Calculate length of string ii. String reversal iii. Equality check of two strings iv. Check palindrome v. Check substring
16	To copy contents of one file to other. While copying a) all full stops are to be replaced with commas b) lower case are to be replaced with upper case c) upper case are to be replaced with lower case.
17	To count total characters in file, total words in file, total lines in file and frequency of given word in file.
18	Create class EMPLOYEE for storing details (Name, Designation, gender, Date of Joining and Salary). Define function members to compute a) total number of employees in an organization b) count of male and female employee c) Employee with salary more than 10,000 d) Employee with designation "Asst Manager"
19	Create class STORE to keep track of Products (Product Code, Name and price). Display menu of all products to user. Generate bill as per order.

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20	Calculator with basic functions. Add more functionality such as graphic user interface and complex calculations.
21	Program that simulates rolling dice. When the program runs, it will randomly choose a number between 1 and 6 (Or other integer you prefer). Print that number. Request user to roll again. Set the min and max number that dice can show. For the average die, that means a minimum of 1 and a maximum of 6.
22	Use raspberry pi/or similar kit and python for- • Room Temperature Monitoring System • Motion Detection System • Soil Moisture Sensor • Home Automation System • A robot • Smart mirror or a smart clock. • Smile Detection using Raspberry Pi Camera
23	Guess Number: Randomly generate a number unknown to the user. The user needs to guess what that number is. If the user's guess is wrong, the program should return some sort of indication as to how wrong (e.g., the number is too high or too low). If the user guesses correctly, a positive indication should appear. Write functions to check if the user input is an actual number, to see the difference between the inputted number and the randomly generated numbers, and to then compare the numbers.

Text and Reference Books

1. Reema Thareja, "Python Programming Using Problem Solving Approach", Oxford University Press, ISBN 13: 978-0-19-948017-6
2. R. Nageswara Rao, "Core Python Programming", Dreamtech Press; Second edition ISBN- 10: 938605230X, ISBN-13: 978-9386052308 ASIN: B07BFSR3LL
3. R. G. Dromey, "How to Solve it by Computer", Pearson Education India; 1st edition, ISBN10:8131705625, ISBN-13: 978-8131705629 Maureen Spankle, "Problem Solving and Programming Concepts", Pearson; 9th edition, ISBN-10: 9780132492645, ISBN-13: 9780132492645
4. Romano Fabrizio, "Learning Python", Packt Publishing Limited, ISBN: 9781783551712,1783551712
5. Paul Barry, "Head First Python- A Brain Friendly Guide", SPD O'Reilly, 2nd Edition, ISBN:978-93-5213-482-3
6. Martin C. Brown, "Python: The Complete Reference", McGraw Hill Education, ISBN-10:9789387572942, ISBN-13: 978-9387572942, ASIN: 9387572943
7. Jeeva Jose, P. Sojan Lal, "Introduction to Computing & Problem Solving with Python", Khanna Computer Book Store; First edition, ISBN-10: 9789382609810, ISBN-13: 9789382609810

Mapping of Course outcomes with Program outcomes:

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

1 – Low, 2 – Medium, 3 – High

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