National Education Policy (NEP) Compliant Curriculum Structure

For

B.Tech Mechanical Engineering

(With effect from Academic Year 2023-24)

Department of Mechanical Engineering

COEP Technological University (COEP Tech)

A Unitary Public University of Government of Maharashtra

(Formerly College of Engineering Pune)

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Vision of the Department:

To be a leader amongst engineering institutions in India, offering value based world class education and constantly pursuing excellence

Mission of the Department:

M1: To offer state-of-the-art undergraduate, postgraduate and doctoral programmes

M2: To develop employable and skilled undergraduate to accept the global and societal challenges, while imparting quality education at post graduate and research level.

M3: To Foster the passion of life-long learning in all facets of employability

Program Educational Objectives (PEOs)

1. Cater to the needs of Indian as well as multinational industries.
2. Be competent with strong technological background to analyze data, formulate and undertake industrial problems and obtain viable solutions
3. Make successful career in industry / research / higher Studies.
4. Be life-long learning and should be able to work on multi-disciplinary projects.
5. Be Competent for effective communication, in management and in professional skills and ethics.

Program Outcomes

Program Outcomes of Engineering program as per norms (common to all UG/ PG Programmes)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization for the solution of complex engineering problems.

PO2. Problem analysis: Identify, formulate, research literature, and analyses complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. 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 public health and safety, and cultural, societal, and environmental considerations.

PO4. Conduct investigations of complex problems: The problems: • that cannot be solved by straightforward application of knowledge, theories and techniques applicable to the engineering discipline. • that may not have a unique solution. For example, a design problem can be solved in many ways and lead to multiple possible solutions. • that require consideration of appropriate constraints/requirements not explicitly given in the problem statement. (like: cost, power requirement, durability, product life, etc.). • which need to be defined (modeled) within appropriate mathematical frame work. • that often require use of modern computational concepts and tools.

PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling to complex engineering activities, with an understanding of the limitations.

PO6. 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.

PO7. 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.

PO8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. Communication: Communicate effectively on complex engineering activities with the engineering community and with t h e 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.

PO11. 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.

PO12. 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 technological change.

Program Specific Objectives (PSOs)

1. Apply concepts of Design, Production and Thermal-fluid sciences to solve engineering problems utilizing advanced technology.

2. Use mechanical engineering software for the design and analysis of mechanical engineering systems/processes.

3. Extend and implement new thoughts on product design and development with the aids of modern CFD and CAD/CAM/CAE tools, while ensuring best manufacturing practices.

UG Program Structure of
B. Tech. (Mechanical Engineering)

List of Abbreviations:

Abbreviation	Title	No of courses	Credits	% of Total Credits
BSC	Basic Science Course	5	14	8.75
ESC	Engineering Science Course	6	16	10
PCC	Program Core Course	17	55	34.37
PEC	Program Elective Course	6	19	11.87
OE/SE	Open/School Elective (other than particular program)	3	06	3.75
MD M	Multidisciplinary Minor	5	14	8.75
VSEC	Vocational and Skill Enhancement Course	4	06	3.75
AEC-01	Ability Enhancement Course	1	02	1.25
AEC-02	Indian Language	1	02	1.25
HSSM	Entrepreneurship/Economics/ Management Courses	2	04	2.5
IKS	Indian Knowledge System	1	02	1.25
VEC	Value Education Course	2	02	1.25
RM	Research Methodology	1	02	1.25
CEA	Community Engagement Activity /Field Project	1	02	1.25
CCA	Co-curricular & Extracurricular Activities	2	02	1.25
ELC	Internship/ Projects	3	12	7.5
	Total	**16**	**160**	**100 %**

B. Tech Mechanical Engineering			FY B. Tech						Semester I
Sl. No.	Course Code	Course Type	Course Title	Engagement Hrs / Week					Credits
				L	T	P	S	Total	
Induction Program(72 Hrs)									
1	MEMBSC101	BSC	Linear Algebra	2	1	0	0	3	3
2	MEMBSC102	BSC	Engineering Physics	2	0	2	1	4	3
3	MEMESC103	ESC	Basics of Electrical & Electronics Engineering	2	0	2	1	4	3
4	MEMESC104	ESC	Engineering Drawing & Graphics	1	0	4	1	5	3
5	MEMESC105	ESC	Engineering Mechanics	3	0	2	1	5	4
6	MEMCCA106	AEC	Communication Skills	1	0	2	0	3	2
7	MEMAEC107	CCA	Liberal Learning Course	0	0	2	0	2	1
8		VSEC	Manufacturing Practices/ Fab Lab - I	0	0	2	1	2	1
Total Academic Engagement and Credits							**5**	**27**	**20**

B. Tech Mechanical Engineering			FY B. Tech						Semester II
Sl. No.	Course Code	Course Type	Course Title	Engagement Hrs / Week					Credits
				L	T	P	S	Total	
1	MEMBSC201	BSC	Engineering Chemistry	2	0	2#	1	4	3
2	MEMBSC202	BSC	Univariate and Multivariate Calculus	2	1	0	0	3	3
3	MEMBSC203	BSC	Biology for Engineers	2	0	0	1	2	2
4	MEMESC204	ESC	Systems in Mechanical Engineering	2	0	2	1	4	3
5	MEMESC205	ESC	Programming for Problem Solving	1	0	2	0	3	2
6	MEMESC206	ESC	Design Thinking and Idea Lab	0	0	2	1	2	1
7	MEMPCC207	PCC	Materials Science	2	0	0	1	4	2
8	MEMIKS208	VSEC	Manufacturing Practices/ Fab Lab - II	0	0	2	1	2	1
9	MEMVSEC209	IKS	Indian Knowledge System	2	0	0	0	2	2
10	MEMCCA210	CCA	Co-curricular & Extracurricular Activity (Office Automation)	0	0	2	0	2	1
Total Academic Engagement and Credits							**6**	**26**	**20**

 # combined lab for Applied Chemistry and Material science

Exit Option to Qualify Certification: Any Three (03) Skill based Courses -:									
11	MEMPCC211	PCC	Computer Aided Geometric Modeling	0	0	4	0	4	2
12	MEMPCC212	PCC	Basics of 3D printing	0	0	4	0	4	2
13	MEMPCC213	PCC	Additive Manufacturing	0	0	4	0	4	2
14	MEMPCC214	PCC	Metallurgical Lab Practice - I	0	0	4	0	4	2
15	MEMPCC215	PCC	Basics of Robotics and AI	0	0	4	0	4	2

B. Tech Mechanical Engineering			SY B. Tech.						Semester III
Sl. No.	Course Code	Course Type	Course Title	Engagement Hrs / Week					Credits
				L	T	P	S	Total	
1	MEMPCC301	PCC	Engineering Thermodynamics	3	0	2	0	5	4
2	MEMPCC302	PCC	Solid Mechanics	2	0	0	1	2	2
3	MEMPCC303	PCC	Machine Drawing & Geometric Modeling	1	0	2	1	3	2
4	MEMPCC304	PCC	Manufacturing Technology	2	0	2	1	4	3
5	MEMOEL305	OE	Open Elective I	2	0	0	0	2	2
6	MEMVEC306	VEC	Humanity Science	1	0	0	0	1	1
7	MEMAEC307	AEC	Modern Indian language	2	0	0	0	2	2
8	MEMCEA308	CEA	Field Project	0	0	4	0	4	2
9	MEMMPC309	MP	Minor Program Course 1	2	0	0	1	2	2
10	MEMIDE310	IDE	Entrepreneurship 1	2	0	0	1	2	2
Total Academic Engagement and Credits							**5**	**27**	**22**

B. Tech Mechanical Engineering			SY B. Tech.						Semester IV
Sl. No.	Course Code	Course Type	Course Title	Engagement Hrs / Week					Credits
				L	T	P	S	Total	
1	MEMPCC401	PCC	Fluid Mechanics	3	0	2	1	5	4
2	MEMPCC402	PCC	Design of Machine Elements	2	1	0	1	3	3
3	MEMPCC403	PCC	Kinematics of Machines	3	0	2	1	5	4
4	MEMMPC404	MP	Minor Program Course 2	3	0	0	0	3	3
5	MEMOEC405	OE	Open Elective Course 2	2	0	0	1	2	2
6	MEMIDE406	IDE	Entrepreneurship 2	2	0	0	2	2	2
7	MEMVSEC407	VSEC	Numerical Methods and Programming Language	1	0	2	1	3	2
8	MEMVEC408	VEC	Environmental Science	1	0	0	1	1	1
Total Academic Engagement and Credits							**8**	**24**	**21**

Exit Option to qualify for Diploma:									
9	MEMPCC407	PCC	CNC Programming	0	0	4	0	4	2
10	MEMPCC408	PCC	Mini Project	0	0	8	0	8	**4**

B. Tech Mechanical Engineering			TY B. Tech.						Semester V
Sl. No.	Course Code	Course Type	Course Title	Engagement Hrs / Week					Credits
				L	T	P	S	Total	
1	MEMPCC501	PCC	Heat Transfer	3	0	2	1	5	4
2	MEMPCC502	PCC	Dynamics of Machine	3	0	2	0	5	4
3	MEMPCC503	PCC	Metrology & Measurement	2	0	2	1	4	3
4	MEMPEC504	PEC	Program Elective Course -I (Specify List) *	2	0	2	1	4	3
5	MEMMPC505	MP	Minor Program Course 3	3	0	0	0	3	3
6	MEMOEC506	OE	Open Elective Course 3	2	0	0	1	2	2
7	MEMELC507	ELC	Internship 1	0	0	6	0	6	3
Total Academic Engagement and Credits							4	29	22

*Program Elective Course I – Discipline-wise List		
Design Engineering	Thermal Engineering/Fluid Science	Manufacturing Science and Engineering
Finite Element Methods (FEM)	Fluid Dynamics	Advanced Manufacturing Technology
Experimental Stress Analysis	Internal Combustion Engines	Industrial Engineering & Operation Research

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B. Tech Mechanical Engineering			TY B. Tech.						Semester VI
Sl. No.	Course Code	Course Type	Course Title	Engagement Hrs / Week					Credits
				L	T	P	S	Total	
1	MEMPCC601	PCC	Mechanical System Design	3	0	2	1	5	4
2	MEMPCC602	PCC	Computer Aided Design and Manufacturing	3	0	2	1	5	4
3	MEMPCC603	PCC	Fluid Machinery	3	0	2	0	5	4
4	MEMPEC604	PEC	Program Elective Course -II (Specify List) *	3	0	2	0	5	4
5	MEMMPC605	MP	Minor Program Course 4	3	0	0	1	3	3
6	MEMVSEC606	VSEC	Mini project	0	0	4	2	4	2
Total Academic Engagement and Credits							5	28	21

Exit Option to B VOC:									
7	MEMPCC607	PCC	Finite Element Analysis	2	0	2	0	4	3
8	MEMPCC608	PCC	Generative Design	2	0	2	0	4	3

*Program Elective Course II – Discipline-wise List			
Design Engineering	Thermal Engineering/Fluid Science	Manufacturing Science and Engineering	Other Disciplines
Advanced Finite Element Methods (FEM)	Principle Of Hydraulic Machines and System Design	Micro & Nano Machining	Headform Engineering
Tribology	Computational Fluid Dynamics	Additive Manufacturing	Automotive Technology
Piping Design	Heat Exchangers: Fundamentals and Design Analysis	Tool and Die Design	Railway Engineering

B. Tech Mechanical Engineering			B. Tech.						Semester VII
Sl. No.	Course Code	Course Type	Course Title	Engagement Hrs / Week					Credits
				L	T	P	S	Total	
1	MEMPCC701	PCC	Energy Conversion	2	0	0	1	2	2
2	MEMPCC702	PCC	Refrigeration and Air conditioning	2	0	2*	1	4	3
3	MEMPCC703	PCC	Vibration and Acoustics	2	0	2	1	4	3
4	MEMPEC704	PEC	Program Elective Course -III (Specify List) *	3	0	0	0	3	3
5	MEMPEC705	PEC	Program Elective Course -IV (Specify List) **	3	0	0	0	3	3
6	MEMELC706	ELC	Internship 2	0	0	6		6	3
7	MEMRMI707	RM	Research Methodology and IPR	2	0	0	2	2	2
8	MEMMPC708	MP	Minor Program Course 5	3	0	0	1	3	3
Total Academic Engagement and Credits							6	27	22

*Program Elective Course III – Discipline-wise List			
Design Engineering	Thermal Engineering/Fluid Science	Manufacturing Science and Engineering	Other Disciplines
CAD/CAM Customization	Advanced Computational Fluid Dynamics	Advanced Joining Techniques	Hybrid and Electric Vehicles
Mechanics of Composite Materials	Design of Thermal Systems	Reverse Engineering	Design of Defense Equipments
Steel Structure Design	Turbomachinery	Production and Operations Management	Aerospace Engineering

**Program Elective Course IV – Discipline-wise List			
Design Engineering	Thermal Engineering/Fluid Science	Manufacturing Science and Engineering	Other Disciplines
Design Optimisation	Renewable Energy Resources	Metal forming Technology	Biomedical Engineering
Product design and development	Solar Energy Engineering and Systems	Industrial Safety Engineering	Condition Monitoring
Vehicle Dynamics	Biomechanics	Plastic & Rubber Technology	Industry 4.0

B. Tech Mechanical Engineering			B. Tech.						Semester VIII
Sl. No.	Course Code	Course Type	Course Title	Engagement Hrs / Week					Credits
				L	T	P	S	Total	
1	MEMPEC801	PEC	Program Specific Elective- V (Specify List) *	3	0	0	3	3	3
2	MEMPEC802	PEC	Program Specific Elective- VI (Specify List) **	3	0	0	3	3	3
3	MEMELC803	ELC	Internship/ Project	0	0	12	6	12	6
Total Academic Engagement and Credits							12	18	12

*Program Elective Course V – Discipline-wise List			
Design Engineering	Thermal Engineering/Fluid Science	Manufacturing Science and Engineering	Other Disciplines
Farm Machinery Design	Air Conditioning System Design	AI for Manufacturing	Dental Engineering
Design for Fatigue and Fracture	Power Plant Engineering	Enterprise Resource Planning (ERP)	Machine Learning for Mechanical Engineering
Mechatronics	Thermal Design and Management of Systems	Advanced Foundry and Forging technology	Sustainable and Green Energy

**Program Elective Course VI – Discipline-wise List			
Design Engineering	Thermal Engineering/Fluid Science	Manufacturing Science and Engineering	Other Disciplines
Fundamentals Of Food Process Design	Microfluidics And Nano-fluids	Advanced Framework Design	Sugar Technology
Automatic Control System	Fundamentals of Nuclear Power Generation	Product Lifecycle Management (PLM)	Robotics & AI
Material Handling System Design	Marine Engineering	Reliability Engineering	Dairy Plant Engineering

Open Electives- Mechanical Engineering

Semester	Course offered	Teaching scheme				Credits
		L	T	P	Hrs	
III	Computer Aided 3D Geometric Modelling	1	-	2	3	3
IV	Engineering Thermodynamics and heat Transfer	3	-	-	-	3
V	Condition Based Health Monitoring	2	1	-	-	3

Multidisciplinary Minors- Mechanical Engineering

Semester	Course offered	Teaching scheme				Credits
		L	T	P	Hrs	
III	Automotive Technology	2	-	-	2	2
IV	Design of Machine Elements	3	-	-	3	3
V	Renewable Energy	3	-	-	3	3
VI	Heat Transfer	3	-	-	3	3
VII	Finite Element Methods	3	-	-	3	3
	Total	**14**	**-**	**-**	**14**	**14**

Double Minors and Honors (Additional 20 Credits)

Double minors – Mechanical Engineering for other Branches

Semester	Course offered	Teaching scheme				Credits
		L	T	P	Hrs	
III	Automotive Technology	2	-	-	2	2
IV	Design of Machine Elements	3	-	-	3	3
V	Renewable Energy	3	-	-	3	3
VI	Heat Transfer	3	-	-	3	3
VII	Finite Element Methods	3	-	-	3	3
	Total	**14**	**-**	**-**	**14**	**14**

Honors- Mechanical Engineering - Design Engineering

Semester	Course offered	Teaching scheme				Credits
		L	T	P	Hrs	
III	Hydraulic And Pneumatic System	3	1	-	3	4
IV	Fracture Mechanics	3	1	-	3	4
V	Advanced Vibration and Acoustics	3	1	-	3	4
VI	Optimisation Techniques in Design	3	1	-	3	4
VII	Mathematical Methods In Engineering	3	1	-	3	4
	Total	**15**	**5**	**-**	**15**	**20**

Honors- Mechanical Engineering - Thermal Engineering

Semester	Course offered	Teaching scheme				Credits
		L	T	P	Hrs	
III	Fluid Dynamics	3	1	-	3	4
IV	Computational Fluid Dynamics	3	1	-	3	4
V	Advanced Heat Transfer	3	1	-	3	4
VI	Design of Thermal Systems	3	1	-	3	4
VII	Mathematical Methods In Engineering	3	1	-	3	4
	Total	**15**	**5**	**-**	**15**	**20**

Note: The Courses selected for Honors degree from the pool of the electives by a particular student should not be part of mandatory 160 regular credits.

Honors- Mechanical Engineering - Research

Semester	Course offered	Teaching scheme				Credits
		L	T	P	Hrs	
III	Problem Identification and Definition	3	1	-	3	4
IV	Literature Review	3	1	-	3	4
V	Experimental Work/Analytical Tools and Prototype Development	3	1	-	3	4
VI	Data Analysis	3	1	-	3	4
VII	Publication	3	1	-	3	4
	Total	**15**	**5**	**-**	**15**	**20**

B.Tech. Honors with Research and Multidisciplinary Minor

Semester	Course offered	Teaching scheme				Credits
		L	T	P	Hrs	
VI	Research Project (Part 1) Problem Identification and Definition, Literature Review, Experimental Work					10
VII	Research Project (Part 2) Prototype Development, Data Analysis, Publication					10
	Total					**20**

Honors- Mechanical Engineering

For Honors in Mechanical Engineering, students should select below courses of 20 credits from the pool of electives given below. These selected courses should not be part of mandatory 160 regular credits.

*Program Elective Course I – Discipline-wise List		
Design Engineering	**Thermal Engineering/Fluid Science**	**Manufacturing Science and Engineering**
Finite Element Methods (FEM)	Fluid Dynamics	Advanced Manufacturing Technology
Experimental Stress Analysis	Internal Combustion Engines	Industrial Engineering & Operation Research

***Program Elective Course II – Discipline-wise List**

Design Engineering	**Thermal Engineering/Fluid Science**	**Manufacturing Science and Engineering**
Advanced Finite Element Methods (FEM)	Principle Of Hydraulic Machines and System Design	Micro & Nano Machining
Tribology	Computational Fluid Dynamics	Additive Manufacturing
Piping Design	Heat Exchangers: Fundamentals and Design Analysis	Tool and Die Design

*Program Elective Course III – Discipline-wise List			
Design Engineering	**Thermal Engineering/Fluid Science**	**Manufacturing Science and Engineering**	
CAD/CAM Customization	Advanced Computational Fluid Dynamics	Advanced Joining Techniques	
Mechanics of Composite Materials	Design of Thermal Systems	Reverse Engineering	
Steel Structure Design	Turbomachinery	Production and Operations Management	

**Program Elective Course IV – Discipline-wise List			
Design Engineering	**Thermal Engineering/Fluid Science**	**Manufacturing Science and Engineering**	
Design Optimisation	Renewable Energy Resources	Metal forming Technology	
Product design and development	Solar Energy Engineering and Systems	Industrial Safety Engineering	
Vehicle Dynamics	Biomechanics	Plastic & Rubber Technology	

*Program Elective Course V – Discipline-wise List			
Design Engineering	**Thermal Engineering/Fluid Science**	**Manufacturing Science and Engineering**	
Farm Machinery Design	Air Conditioning System Design	AI for Manufacturing	
Design for Fatigue and Fracture	Power Plant Engineering	Enterprise Resource Planning (ERP)	
Mechatronics	Thermal Design and Management of Systems	Advanced Foundry and Forging technology	

**Program Elective Course VI – Discipline-wise List			
Design Engineering	**Thermal Engineering/Fluid Science**	**Manufacturing Science and Engineering**	
Fundamentals Of Food Process Design	Microfluidics And Nano-fluids	Advanced Framework Design	
Automatic Control System	Fundamentals of Nuclear Power Generation	Product Lifecycle Management (PLM)	
Material Handling System Design	Marine Engineering	Reliability Engineering	