

UG SCHEME 2022: Department of Mechanical Engineering

Malaviya National Institute of Technology Jaipur

Vision, Mission, PEO, PO, PSO

Vision Statement of the institution

To create a centre for imparting technical education of international standards and conduct research at the cutting edge of technology to meet the current and future challenges of technological development.

Mission Statement of the institution

To create technical manpower for meeting the current and future demands of industry: To recognize education and research in close interaction with industry with emphasis on the development of leadership qualities in the young men and women entering the portals of the Institute with sensitivity to social development and eye for opportunities for growth in the international perspective.

Vision of the Department: To create a center of international standard for imparting education in Mechanical Engineering and conducting research at the cutting edge of technology to meet the current and future challenges of technological development.

Mission of the Department: To develop an excellent teaching, learning & research ecosystem for producing leading technocrats, innovators, and entrepreneurs in the field of Mechanical Engineering.

Key elements of Mission

M1: Quality Teaching and Research

M2: Problem-solving skills.

M3: Team building and leadership

M4: Technocrats, Innovators and Entrepreneurs

Program Educational Objectives:

PEO-1: Mechanical graduates will have strong fundamental technical knowledge and are capable to develop core competency in diversified areas such as production, design, thermal and industrial engineering.

PEO-2: Graduates will be capable of using software tools related to core and applied areas of their discipline to expand their knowledge horizon beyond books and to equip them with industrial and experimental practices. This is in addition to focusing on problem-solving, decision-making skills, contributing to overall personality and career development.

PEO-3: Graduates will have improved team building, team working and leadership skills with high regard for ethical values.

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Program Outcomes (PO) -UG	
PO1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	Problem analysis: Identify, formulate, review research literature, and analyse 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 the public health and safety, and the cultural, societal, and environmental considerations.
PO4	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.
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 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.
Program Specific Outcomes (PSO)-UG	
PSO1	Capability to innovate, design, analyse and develop mechanical systems
PSO2	Ability to apply technological and managerial skills to become Technocrats and Entrepreneurs.

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First Year (I and II Semester)

S. No	Course Code	Course Title	Category	L	T	P	Credits	No of Hrs	Total Credit	Syllabus at Page-No.
1	22CYT101	Engineering Chemistry	BS	2	1	0	3	3		
2	22ECP101	Engineering Chemistry Lab	BS	0	0	2	1	2		
3	22PHT101	Classical Physics	BS	2	1	0	3	3		
4	22PHP103	Classical Physics Lab	BS	0	0	2	1	2		
5	22MAT101	Mathematics I	BS	3	1	0	4	4		
6	22MAT102	Mathematics II	BS	3	1	0	4	4		
7	22EET107	Basics of Electrical Eng.	EAS	2	0	0	2	2		
8	22EEP102	Electrical Engineering Lab	EAS	0	0	2	1	2		
9	22ECT108	Basics of Electronics Eng.	EAS	2	0	0	2	2		
10	22ECP101	Electronics Engineering Lab	EAS	0	0	2	1	2		
11	22CET112	Engineering Drawing and Sketching	EAS	1	0	0	1	1		
12	22CEP113	Engineering Drawing and Sketching Lab	EAS	0	0	2	1	2		
13	22CST101	Programming with Python	EAS	2	0	0	2	2		
14	22CSP102	Programming with Python Lab	EAS	0	0	2	1	2		
15	22CET102	Environmental Science	EAS	2	0	0	2	2		
16	22MET101	Introduction to Mechanical Systems	EAS	2	0	0	2	2		12
17	22MEP102	Product Realization through Manufacturing	EAS	0	0	2	1	2		13
18	22HST101	Basic Economics	HSS	2	0	0	2	2		
19	22HST106	English Communication Skills	HSS	2	0	0	2	2		
20	22HSP107	Communication Skills lab	HSS	0	0	2	1	2		
							37	45	37	
21	22MET103	Applied Probability and Statistics	PC	2	1	0	3	3		Sem I-14
22	22MET104	Casting, Welding and Forming	PC	3	0	0	3	3		Sem I-15
23	22MEP105	Casting, Welding and Forming Lab	PC	0	0	2	1	2		Sem I-16
24	22MET106	Engineering Thermodynamics	PC	3	1	0	4	4		Sem II-17
25	22MET107	Engineering Mechanics	PC	2	1	0	3	3		Sem II-18
							14	15	14	
							51	60		

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III Semester										
S. No	Course Code	Course Title	Category	L	T	P	Credits	No of Hrs	Total Credit	Syllabus at Page-No.
1	22MET201	Fluid Mechanics	PC	3	1	0	4	4		19
2	22MET202	Kinematics of Machines	PC	2	1	0	3	3		20
3	22MET203	Materials Science and Engineering	PC	3	0	0	3	3		21
4	22MET204	Mechanical Measurements and Metrology	PC	3	0	0	3	3		22
5	22MET205	Solid Mechanics	PC	3	1	0	4	4		23
6	22BMT921	Basics of Management	Mgt.	3	0	0	3	3		---
7	22MEP206	Computer-Aided Machine Drawing	PC	0	0	4	2	4		24
8	22MEP207	Fluid Mechanics Lab	PC	0	0	2	1	2		25
9	22MEP208	Materials Science and Engineering Lab	PC	0	0	2	1	2		26
10	22MEP209	Mechanical Measurements and Metrology Lab	PC	0	0	2	1	2		27
							25	31	25	
IV Semester										
1	22MET251	Dynamics of Machines	PC	3	1	0	4	4		28
2	22MET252	Heat Transfer	PC	3	1	0	4	4		29
3	22MET253	I C Engines	PC	3	0	0	3	3		30
4	22MET254	Operations Planning and Control	PC	2	1	0	3	3		31
5	22MET255	Science of Machining	PC	3	1	0	4	4		32
6	22MEP256	Heat Transfer Lab	PC	0	0	2	1	2		33
7	22MEP257	I C Engines Lab	PC	0	0	2	1	2		34
8	22MEP258	Kinematics and Dynamics of Machines Lab	PC	0	0	2	1	2		35
9	22MEP259	Science of Machining Lab	PC	0	0	2	1	2		36
10	xxxxxxx	Program Elective-1	PE				3	3		---
							25	29	25	

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V Semester										
S. No	Course Code	Course Title	Category	L	T	P	Credits	No of Hrs	Total Credit	Syllabus at Page-No
1	22MET301	CAD & CAM	PC	3	0	0	3	3		37
2	22MET302	Design of Machine Elements	PC	3	1	0	4	4		38
3	22MET303	Fluid and Turbo Machines	PC	3	1	0	4	4		39
4	22MET304	Industrial Engineering	PC	2	0	0	2	2		40
5	22MET305	Operations Research	PC	2	1	0	3	3		41
6	22EET341	Control System Engineering	PL-EAS	3	1	0	4	4		---
7	22MEP306	CAD & CAM Lab	PC	0	0	2	1	2		42
8	22MEP307	Industrial Engineering Lab	PC	0	0	2	1	2		43
		Semester Credits in B Tech(Only)					22	24	22	
9	xxxxxxx	Honors-1	HE				3			----
10	xxxxxxx	Honors-2	HE				3			---
		Semester Credits in B Tech(Hon.)					28	30	28	
11	xxxxxxx	<i>Introduction to Standardization</i>	<i>Audit</i>	<i>1</i>	<i>0</i>	<i>0</i>	<i>1</i>	<i>1</i>		---
VI Semester										
1	22MET351	Advanced Machining & Additive Manufacturing	PC	3	0	0	3	3		44
2	22MET352	Design of Mechanical Systems	PC	3	1	0	4	4		45
3	22MET353	Refrigeration and Air Conditioning	PC	2	1	0	3	3		46
4	22MEP354	Advanced Machining & Additive Manufacturing Lab	PC	0	0	2	1	2		47
5	22MEP355	Computer Aided Engineering Lab	PC	0	0	2	1	2		48
6	22MEP356	Refrigeration & Air-conditioning Lab	PC	0	0	2	1	2		49
7	xxxxxxx	Program Elective-2	PE				3	3		---
8	xxxxxxx	Program Elective-3	PE				3	3		---
9	xxxxxxx	Program Elective-4	PE				3	3		---
		Semester Credits in B Tech(Only)					22	25	22	
10	xxxxxxx	Honors-3	HE				3			---
11	xxxxxxx	Honors-4	HE				3			---
		Semester Credits in B Tech(Hon.)					28	31	28	

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VII Semester										
S. No	Course Code	Course Title	Category	L	T	P	Credits	No of Hrs	Total Credit	Syllabus at Page-No
1	22MEO401	Training Seminar	PC	0	0	4	2	4		50
2	xxxxxxx	Program Elective-5	PE				3	3		---
3	xxxxxxx	Program Elective-6	PE				3	3		---
4	xxxxxxx	Program Elective-7	PE				3	3		---
5	xxxxxxx	Open Elective -I	OE				3	3		---
6	22MEW402	Minor Project	Proj./PC	0	0	6	3	6		51
		Semester Credits in B Tech (Only)					17	22	17	
7	xxxxxxx	Honors-5	HE				3			---
		Semester Credits in B Tech (Hon.)					20	25	20	
VIII Semester										
1	22MEW980	Major Project	Proj./PE	0	0	18	9	18		52
2	xxxxxxx	Program Elective-8	PE				3	3		---
3	xxxxxxx	Program Elective-9	PE				3	3		---
4	xxxxxxx	Open Elective -2	OE				3	3		---
		Semester Credits in B Tech (Only)					18	18	18	
5	xxxxxxx	Honors-6	HE				3			---
		Semester Credits in B Tech (Hon.)					21	21	24	
Total Credits in B Tech (Only)									180	
Total Credits in B Tech (with Honors)									198	

Note: The Mini Project (3 credits) in 7th Semester will be compulsory for all students of the department. Major Project (9 credits) will be optional for B.Tech. only program, and the student may earn the required credits against Major Project through elective courses offered by the Department in Even Semester. However, students opting for Honors / Minor specialization / Internship have to compulsorily register for Major project in VIII semester.

As there is no provision of waiver for core courses, the students opting for semester-long internship in the VII semester may submit a report of the work done during their internship or they can carry out an independent project against the minor project.

Students opting for internship in VIII Sem will complete their major project with one supervisor each at the Institute and at the organization offering internship. In this regard, the guidelines for internship, as decided by the Institute from time to time, shall be applicable.

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List of Program Electives / Open Electives										
Sem.	Course Code	Course Title	Category	L	T	P	Credits	No of Hrs	Total Credit	Syllabus at Page- No
4th	22MET921	Applied Machine Learning	PE1	2	1	0	3	3	3	53
	22MET922	Mechatronics in Manufacturing		2	1	0	3	3		54
	22MET923	Work Study and Ergonomics		2	1	0	3	3		55
6th	22MET925	Automobile Engineering	PE2, PE-3 and PE4	3	0	0	3	3	9	56
	22MET928	Design of Heat Exchangers		2	1	0	3	3		57
	22MET929	Design of Mechanisms		2	1	0	3	3		58
	22MET930	Design Thinking for Innovations		2	1	0	3	3		59
	22MET935	Product Design and Development		2	1	0	3	3		60
	22MET936	Robotics Engineering		3	0	0	3	3		61
	22MET940	Finite Element Methods		3	0	0	3	3		62
	22MET941	Friction, Wear and Lubrication		3	0	0	3	3		63
	22MET944	Mechanical Vibrations and Control		3	0	0	3	3		64
	22MET945	Metal Forming		3	0	0	3	3		65
	22MET946	Power Plant Engineering		3	0	0	3	3		66
	22MET949	Project Management		3	0	0	3	3		67
22MET950	Quality System Engineering	3	0	0	3	3	68			
22MET952	Supply Chain Management	2	1	0	3	3	69			
7th	22MET954	Air Conditioning System Design	PE5, PE6 and PE7	2	1	0	3	3	9	70
	22MET957	Entrepreneurship & Business Incubation		2	1	0	3	3		71
	22MET959	Industry 4.0		3	0	0	3	3		72
	22MET960	Intellectual Property Rights & Tech. Transfer		2	1	0	3	3		73
	22MET961	Lean Six Sigma		3	0	0	3	3		74
	22MET962	Material Selection in Mechanical Design		3	0	0	3	2		75
	22MET963	Mechanics of Composites		3	0	0	3	3		76
	22MET965	Occupational Health and Safety		3	0	0	3	3		77
	22MET967	Tool Engineering		3	0	0	3	2		78
22MET968	Welding Engineering & Technology	3	0	0	3	3	79			
8th	22MET969	Advanced Engineering Materials	PE8 and PE9	3	0	0	3	3	6	80
	22MET970	Computational Fluid Dynamics		3	0	0	3	3		81
	22MET971	Data Analytics		3	0	0	3	3		82
	22MET972	Flexible Manufacturing System		3	0	0	3	3		83
	22MET973	Fracture Mechanics		3	0	0	3	3		84
	22MET974	Machinery Fault Diagnosis		3	0	0	3	3		85
	22MET975	Microfluidics		3	0	0	3	3		86
	22MET976	Reliability and Maintainability Engineering		3	0	0	3	3		87
	22MET977	Smart Manufacturing		3	0	0	3	3		88
	22MET978	Sustainable Mfg. & Life Cycle Engg		3	0	0	3	3		89
Total Courses			09 Courses out of 34					27		

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Honors offered by Mechanical Engineering Department										
S. No	Course Code	Course Title	Sem.				Credits	No of Hrs	Total Credit	Remarks
				L	T	P				
Advanced Manufacturing Technologies[§]										
1	22MET932	Metal Additive Manufacturing	V	3	0	0	3	3		90
2	22MEP937	AM, PM&M, Mfg. Automation Lab	V	0	0	6	3	6		94
3	22MET943	Manufacturing Automation	VI	3	0	0	3	3		91
4	22MET947	Precision Manufacturing and Measurement	VI	3	0	0	3	3		92
5	22MET964	Micro-Nano Fabrication	VII	2	1	0	3	3		93
6	22MEW981	Mini Project on AMTs	VIII	0	0	6	3	6	18	95
Supply Chain Analytics										
1	22MET927	Data Science for Supply Chain Management	V	2	1	0	3	3		96
2	22MET933	Modelling Sustainability	V	2	1	0	3	3		97
3	22MET938	Business Logistics	VI	2	1	0	3	3		98
4	22MET948	Prescriptive Analytics	VI	2	1	0	3	3		99
5	22MET966	Supply Chain 4.0	VII	2	1	0	3	3		100
6	22MEW983	Mini Project on Supply Chain Analytics	VIII	0	0	6	3	6	18	101
Robotics & Automation[#]										
1	22MET926	Control of Robots and Automation Systems	V	3	0	0	3	3		102
2	22MET931	Kinematics and Dynamics of Robotic Manipulators	V	2	1	0	3	3		103
3	22MET951	Robot Vision and Sensing	VI	3	0	0	3	3		104
4	22MET955	Artificial Intelligence for Robotic systems	VII	2	1	0	3	3		105
5	22MEP953	Programming, Control and Automation Lab	VI	0	0	6	3	3		106
6	22MEW982	Mini Project on Robotics and Automation	VIII	0	0	6	3	6	18	107
Advanced Thermal Systems										
1	22MET924	Advanced Fluid Mechanics	V	3	0	0	3	3		108
2	22MET934	Numerical Methods and Data Visualization	V	2	1	0	3	3		109
3	22MET939	Environment, Social and Governance	VI	2	1	0	3	3		110
4	22MET942	High Performance computing and AI in thermal-fluid system	VI	2	1	0	3	3		111
5	22MET956/ 22MET958	A. Computational Heat Transfer / B. Experimental Methods in Thermal Sciences	VII	3	0	0	3	3		112 113
6	22MEP979	Thermal simulation Lab & Mini Project	VIII	0	0	6	3	6	18	114

[§]Minor available for the UG students of other Departments.

[#]Minor available for the UG students of other Departments.

RULES FOR HONORS AND MINOR SPECIALIZATION

- A. The students will have the option to choose from a basket of multiple sub-domains within the parent department (through Honors) or sub-domains of departments other than the parent department (Minor Specialization).
- B. Requirements for Honors and Minor Specialization programs
 - i. Honors and Minor programs start from V Semester
 - ii. Minimum CGPA requirements for registration shall be 7.50 at the end of IV semester. Students of a department will be allowed to register for Honors program offered by their parent department, while students of a department will be allowed to register for Minor program offered by any other department.
 - iii. Number of additional credits shall be 18 with 6 courses (or 5 courses + 1 mini project of 3 credits) as prescribed by the department offering Honors/Minor program.
 - iv. The student is required to plan registration for Honors/Minor program courses, in order to complete all the six courses by the end of VIII semester.
 - v. Maximum number of students enrolled in any course of a Minor program shall be 30. The allotment of students the minor program shall be on the basis of CGPA.
 - vi. The student will not allowed to continue/register for Honors/Minor specialization if his/her CGPA falls below 7.50. In case, his/her CGPA improves to 7.50 or higher in subsequent semester(s), he/she may be allowed to continue.
 - vii. Students should be prepared to write more than one exam in a day.
- C. After successful completion of the requirements of the Honors program, the student will be awarded a degree in "name of the discipline" with Honors (eg Bachelor of Technology in Civil Engineering with Honors or Bachelor of Technology in Mechanical Engineering with Honors etc.)
- D. After successful completion of the requirements of the Minor program, the student will be awarded a degree in "name of the discipline" with minor specialization in "name of the minor specialization" (e.g Bachelor of Technology in Electrical Engineering with Minor Specialization in Environmental Engineering or Bachelor of Technology in Computer Science and Engineering with Minor Specialization in Quantum Mechanics etc.)

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Credit Wise Summary wrt Credit Structure				
Course Type	B Tech Only		B Tech with Honors /Minor	
	Actual	Range	Actual	Range
Institute Core (IC)	37#	37#	37#	37#
Basic Sciences (BS)	16	16	16	16
Fundamental Engg.(EAS)	16#	16#	16#	16#
Humanities & Social Science (HSS)	5	5	5	5
Discipline Specific Courses (DSC)	133	121-139	133+18*	124 - 142 +18*
Program Core (PC)	91	109-136	91	124-154
Program Elective (PE)	27		27+15*	
Project	12	3 to 12	12+3*	3 to 12+3*
Management	3	3	3	0 to 3
Other Courses (OC)	10	9 to 21	10	9 to 21
Open Electives (OE)	6	6	6	6
Program Linked (EAS/BS)	4	3 to 15	4	3 to 15
Total	180	178 to 184	180+18*=198	196 to 202
Audit Course	1	1	1	1
#: Increase of one credit due to split in the course Basic Electrical and Electronics Engg. in two courses of 2 credits each. * Total 18 Extra Credits for Honors/ Minor.				

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Exit Options

A Students will have following exit options:

S. No.	Exit option with	Eligibility condition
1	Undergraduate Diploma	After successfully completing all courses of I to IV semesters or or The student has earned 100 credits through graded courses
2	B.Sc. (Engg.) Degree	After successfully completing all courses of I to VI semesters or The student has earned 142 credits through graded courses
3	B.Tech. Degree/	After successfully completing all courses of I to VIII semesters
4	B. Tech Honors	After successfully completing all courses of I to VIII semesters + 18 Credits

B Maximum duration of completing a UG program shall be 6 years (12 semesters) from initial registration excluding semester withdrawals. If the student has not exercised any exit option and has completed his registration in every semester.

C Maximum duration of completing a UG program shall be 8 years (16 semester) from initial registration excluding semester withdrawals, for students who have exercised any exit option given in table 1 above.

PL-EAS Courses Offered by MED

S. No	Course Code	Course Title	Category	L	T	P	Credits	No of Hrs	Remarks	Syllabus at Page-No
1	22MET291	Introduction to CAD & CAM	PL-EAS	2	0	0	2	2	Even Sem	115
2	22MEP292	Introduction to CAD & CAM Lab	PL-EAS	0	0	2	1	2	Even Sem	116