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Course Structure and Contents
for
M.Tech. in Mechanical Engineering
(For Affiliated Institutes Only)

Syllabus as per the guidelines of National Education Policy 2020
To be implemented from Academic Year 2024-25.
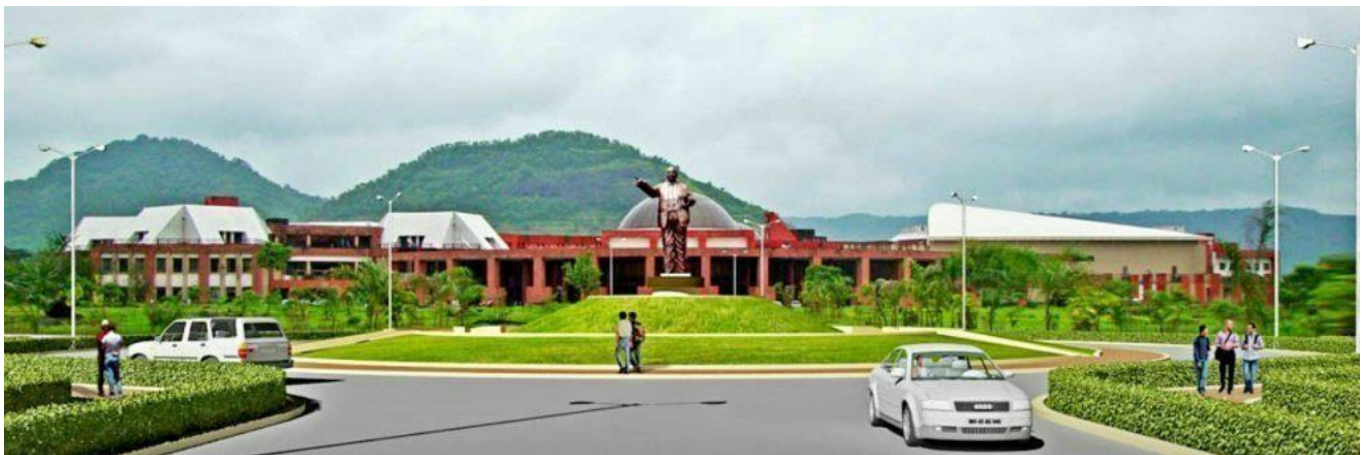
Vision

The vision of the Department is to achieve excellence in teaching, learning, research and transfer of technology and overall development of students.

Mission

Imparting quality education, looking after holistic development of students and conducting need based research and extension activities.

M.Tech. in Electric Vehicle Technology

Program Educational Objectives are broad statements that describe the career and professional accomplishments that the Electrical Vehicle Technology program is preparing graduates to achieve.

Programme Educational Objectives (PEOs)

No.	PEO
PEO1	To emerge as competent professionals and leaders in Electrical Vehicle Technology, contributing to global enterprises while upholding a strong background in ethics and societal responsibilities.
PEO2	To possess the ability to independently conduct research, investigation, and development work in Electrical Vehicle Technology, actively contributing to advancements in the field.
PEO3	To demonstrate a high level of competence in addressing diverse and complex challenges within the domain of Electrical Vehicle Technology, and apply contemporary engineering tools and procedures for sustainable development, while promoting a culture of self-learning and ethical practice in their professional endeavours.
PEO4	To enable post graduates to carry out innovative and independent research work, disseminate the knowledge in Academia/Industry/Research Organizations to develop systems and processes in the related field.

Programme Outcomes (POs)

At the end of the program, the students will be able to:

No.	PO
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 analyze 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:** User 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 modeling 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 teamwork:** 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.
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.

Department PSO's

PSO-1: Engineering graduates can explore knowledge of electrical & electronics engineering in core as well as multidisciplinary areas in innovative, dynamic and challenging environment, for the research based teamwork.

PSO-2: Engineering graduates can provide hands on experience in the fields of Non-conventional and Renewable Energies.

(Effective from AY 2024-25)

	Course Code	Course Title	L	T	P	Credits	Categorization
SEM- III	12612OE301	Open Elective II	3	-	-	3	OE
	12612MD302	Multidisciplinary Minor	3	-	-	3	MD M
	12612PC301	Additive Manufacturing	3	1	-	4	PCC
	12612PR304	Project I	-	-	4	10	ELC
		Total	9	1	4	20	
SEM-IV	12612PR401	Project II	-	-	4	20	ELC
		Total	-	-	4	20	

12612OE301A	STUDENTS PSYCHOLOGY	OE-II	3-0-0	3 Credits
Exam Scheme				
Mid-Sem Test 20 Marks	Continuous Assessment 20 Marks	End-Sem Exam 60 Marks		Total 100 Marks

Course Objectives:

1. Gain an understanding of prominent learning theories and models, enabling you to grasp the foundational concepts that influence effective teaching and learning.
2. Acquire skills to assess and appreciate diverse student characteristics, including learning styles, cultural backgrounds, and individual differences that impact learning.
3. Gain proficiency in understanding, administering, and interpreting psychological tests and inventories to assess cognitive abilities, personality traits, and emotional development in learners.
4. Examine psychological theories of motivation and cultivate the skills needed to apply motivational strategies that enhance student engagement, commitment, and achievement.
5. Investigate the stages of physical, cognitive, emotional, and social development in individuals, equipping you to design instructional methods that support comprehensive growth.
6. Acquire an understanding of NLP concepts and techniques that can be used to improve communication, establish rapport, and optimize teaching and learning experiences.

Course Outcomes: Students will be able to:

CO1	Gain an understanding of prominent learning theories and models, enabling you to grasp the foundational concepts that influence effective teaching and learning.
CO2	Recognition of Diverse Student Needs: Develop the ability to recognize and appreciate the diverse cognitive, emotional, and social needs of students, enabling tailored support and fostering inclusive learning environments.
CO3	Application of Psychological Strategies: Apply psychological theories and principles to address various challenges in student development, including motivation, learning difficulties, and behavioral issues.
CO4	Competence in Student Assessment: Acquire skills in utilizing psychological assessment tools to evaluate students' cognitive abilities, emotional states, and learning styles, informing instructional strategies and support plans.
CO5	Promotion of Positive Learning Experiences: Learn to create positive and conducive learning experiences by integrating insights from student psychology, fostering engagement, motivation, and holistic growth among learners.

Course Title: Business To Business Marketing (B2B)   **Course code: 12612OE301B**

Course Objectives:

1. Learn how to segment B2B markets based on factors such as industry, company size, and purchasing behavior. Understand the significance of effective market segmentation in tailoring marketing strategies to specific B2B customer segments.

2. Explore the elements of the B2B marketing mix, including product/service offerings, pricing strategies, distribution channels, and promotional approaches. Develop the ability to design marketing strategies that align with the unique needs and preferences of B2B customers.

3. Gain insights into relationship-building strategies in B2B contexts. Learn how to nurture long-term, mutually beneficial partnerships with B2B clients through effective communication, trust-building, and value delivery.

Course Outcomes:

1. Foundational Knowledge: Gain a strong grasp of the core concepts and theories that form the basis of B2B marketing, enabling practical application.

2. Market Analysis Expertise: Develop skills to analyse B2B markets, segment customers effectively, and make informed marketing decisions.

3. Strategic Implementation: Acquire the ability to design and execute B2B marketing strategies tailored to the unique needs of business customers.

ORGANISATIONAL BEHAVIOUR

COURSE CODE-12612OE301C

Course Outcomes:

CO1: Students will be able to analyze and understand individual behaviors within organizational.

CO2: Students will develop and refine their interpersonal skills, enabling effective communication, collaboration, and conflict resolution within professional environments.

CO3: Students will gain the ability to assess and manage group dynamics, facilitating teamwork, addressing conflicts, and fostering a productive and cohesive group environment.

CO4 : Students will apply their understanding of individual and group behaviors to enhance organizational effectiveness.

12612OE301D	Principles of Economics	Open Elective-II	3-0-0	3 Credits
Exam Scheme				
Mid-Sem Test 20 Marks	Continuous Assessment 20 Marks	End-Sem Exam 60 Marks		Total 100 Marks

Course Objectives:

1. Introduce essential economic terms and concepts for analyzing real-world situations.
2. Understand market dynamics, supply and demand, and resource allocation.
3. Study national indicators, inflation, unemployment, and government policies' effects.
4. Learn to make informed choices using opportunity cost, utility, and cost analysis.
5. Explore global interdependencies, trade, exchange rates, and policy impacts.
6. To examine the relationship between technology, innovation, and economic growth.

Course Outcomes:

1. Grasp key economic principles, like supply and demand, opportunity cost, and marginal analysis, forming a foundation for economic understanding.
2. Gain insights into market structures, pricing mechanisms, and factors influencing consumer and producer behavior.

3. Understand the role of government interventions, regulations, and fiscal/monetary policies in shaping economic outcomes.
4. Learn how societies allocate scarce resources efficiently, exploring topics like production, distribution, and factors of production.
5. Develop analytical thinking by applying economic principles to real-world scenarios, making informed personal and business decisions.

2612OE301E	INTELLECTUAL PROPERTY RIGHTS	OEC II	3-0-0	Credits: 3
Exam Scheme				
Mid-Sem Test: 20 Marks	Continuous Assessment: 20 Marks	End-Sem Exam: 60 Marks		Total: 100 Marks

Course Prerequisites: Product Design, Design Thinking

Course Outcomes: At the end of the course students will be able to

CO1	State the fundamental terms i.e. trademark, copyright, patents, trade secret etc.
CO2	Interpret laws of trademark, copyright, patents, trade secret and its registration processes.
CO3	Understand the roles and responsibilities of various international organizations, agencies, and treaties.
CO4	Manage and safeguard the intellectual property and protect it against unauthorized use.

Mapping of Course Outcomes with Program Outcomes:

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

12612OE301F	Introduction to Public Administration	Credits 03

Course Objectives:
1. Define public administration and explain its role in society.
2. Identify and analyze the different types of public organizations.
3. Apply public administration theories and principles to real-world problems.
4. Develop the skills and knowledge necessary to pursue a career in public administration.

Course Outcomes:

Upon completion of this course, students will be able to:
1. Define public administration and explain its role in society.
2. Identify and analyze the different types of public organizations.
3. Apply public administration theories and principles to real-world problems.
4. Develop the skills and knowledge necessary to pursue a career in public administration.

12612MD302A	DESIGN OF MECHATRONIC SYSTEMS	Multidisciplinary Minor	3-0-0	3 Credits
Exam Scheme				
Mid-Sem Test 20 Marks	Continuous Assessment 20 Marks	End-Sem Exam 60 Marks		Total 100 Marks

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Course Objectives:

1. To demonstrate proficiency in analyzing and modeling complex mechatronic systems, integrating knowledge of system dynamics, control theory, and signal processing to accurately represent system behavior.
2. To apply advanced control techniques, including Lyapunov theory, to design and implement control strategies for nonlinear systems, achieving stable and accurate trajectory tracking performance.
3. To utilize MATLAB for simulation and analysis of mechatronic systems, demonstrating the ability to validate theoretical models, analyze system responses, and optimize control algorithms.
4. To design and implement digital signal processing algorithms for mechatronic applications, including signal sampling, filtering, and interfacing with digital systems, ensuring effective signal conditioning and processing.
5. To evaluate and critique real-world mechatronic systems and research examples, such as 3D micro-printers and microfabrication platforms, demonstrating an understanding of the practical application of theoretical concepts and innovative engineering solutions.

Course Outcomes: Students will be able to;

CO1	Understand the theoretical foundations of mechatronics, including principles of system dynamics, control theory, and signal processing, with a focus on nonlinear control and digital systems.
CO2	Gain proficiency in mathematical modeling techniques for mechatronic systems, covering frictional dynamics, DC motors, manipulator dynamics, and their simulation using MATLAB.
CO3	Master advanced control methodologies, particularly Lyapunov theory, for designing robust and stable control systems capable of trajectory tracking in nonlinear dynamical systems
CO4	Develop practical skills in implementing digital signal processing techniques, including sampling, filtering, and interfacing with digital systems, essential for real-world mechatronic system implementation.
CO5	Explore cutting-edge research examples and case studies in mechatronics, such as the development of novel systems like 3D micro-printers and microfabrication platforms, to understand the application of theoretical concepts in innovative engineering solutions.

12612 MD 302B	**ETHICAL HACKING**	Multidisciplinary Minor	3-0-0	3 Credits
Exam Scheme				
Mid-Sem Test 20 Marks	Continuous Assessment 20 Marks	End-Sem Exam 60 Marks		Total 100 Marks

Pre-Requisites: Computer Proficiency, Computer Networking

Course Outcomes: At the end of the course the student will be able to:

CO1	Gain a comprehensive understanding of ethical hacking concepts, methodologies, and its role in enhancing cybersecurity.
CO2	Acquire a solid grasp of cybersecurity principles, types of threats, and the importance of proactive defence strategies.
CO3	Develop proficiency in various hacking techniques, including reconnaissance, scanning, exploitation, and post-exploitation activities.
CO4	Perform effective vulnerability assessments on systems and networks, identifying potential security weaknesses and exposures.
CO5	Demonstrate the ability to conduct penetration tests, simulating real-world attacks to evaluate the strength of security measures

Mapping of course outcomes with program outcomes

Course Outcomes	Program Outcomes

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

12612MD302C	Sustainable Power Generation Systems	Credits 03

Course Objectives:

1. The course objective is to provide students a thorough understanding of different renewable energy sources. In particular, this course will cover the design and analysis of power plants that use renewable energy sources.

2. The course will employ practical examples, schematics, and block diagrams to illustrate concepts as needed. Additionally, numerical problems along with their solutions will be thoroughly addressed throughout the course.

3. This course targets undergraduate and postgraduate students specializing in Energy Engineering and Technology.

4. Moreover, the course will prove highly beneficial for students and researchers across diverse academic disciplines seeking to develop novel energy conversion devices and processes.

Course Outcomes:

1. Explain the principles of sustainability in the context of power generation and understand its significance in the global energy transition.

2. Identify and describe various renewable energy sources, including solar, wind, hydro, geothermal, and biomass, and explain their potential for power generation.

3. Examine and contrast pros and cons of various sustainable power generation technologies,

12612MD302D   **Components and Applications of Internet of Things**   **Credits 03**

Course Objectives:

1. The objective of this course is to learn about Basics of IoT, Components of IoT including Sensors and actuators, computing, and communication systems.
2. It will also cover IoT Protocols, Security of IoT, Cloud based design and AI/Deep learning-based analytics.

Course Outcomes:

1. Identify IoT Components: Recognize and classify key components of IoT systems, including sensors, actuators, communication protocols, and data processing units.
2. Explore IoT Communication: Understand various wireless and wired communication technologies used in IoT networks and their suitability for different application scenarios.
3. Design IoT Applications: Create IoT solutions by integrating hardware and software components, demonstrating proficiency in prototyping, programming, and data handling.
4. Analyse Data from IoT Devices: Collect, analyse, and interpret data generated by IoT devices to extract meaningful insights and support informed decision-making.

2612MD302E	LINEAR ALGEBRA	Multidisciplinary Minor	3-0-0	3 Credits
Mid-Sem Test: 20 Marks	Continuous Assessment: 20 Marks	End-Sem Exam: 60 Marks		Total: 100 Marks

Course Objectives:

1. To introduce fundamental concepts of linear algebra.
2. To find bases for vector spaces. To introduce linear transformations and their relation to matrices.
3. Imparting the knowledge of real time applications of mathematical methodologies and models, develop mathematical skills and enhance thinking power of students.

Course Outcomes: Students will be able to

CO1	Students will be able to understand the Euclidean vector spaces, subspaces, eigenvectors, eigen values and inner product spaces.
CO2	Students will be able to analyze concepts of vector space, linear Transformation, diagonalization
CO3	Students will be able to apply Cayley-Hamilton theorem and Rank-Nullity theorem, quadratic forms.
CO4	Students will be able to develop Matrix Transformations in R2, Gram-Schmidt process, Symmetric and Skew-symmetric bilinear forms

Mapping of course outcomes with program outcomes

PO↓ CO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
CO1	2	1										
CO2	2	2	1									
CO3	2	1	1									
CO4	2	1	1	1								

12MD302F	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING	Multidisciplinary Minor	Load/Per Week-03 =03	Credits-03
Exam Scheme				

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Mid-Sem Test 20 Marks	Continuous Assessment 20 Marks	End-Sem Exam 60 Marks	Total 100 Marks

Course Objectives:

1. Apply AI techniques to solve the given problems.

2. Implement trivial AI techniques on relatively large system

3. Explain uncertainty and Problem-solving techniques.

4. Compare various learning techniques**.**

Course Outcomes:

This course will enable students to

CO1	Identify the AI based problems.
CO2	Apply techniques to solve the AI problems.
CO3	Define learning and explain various logic inferences.
CO4	Discuss different learning techniques.

12612PC301	**ADDITIVE MANUFACTURING**	**PCC**	**3-1-0**	**4 Credits**
Exam Scheme				
Mid-Sem Test 20 Marks	Continuous Assessment 20 Marks	End-Sem Exam 60 Marks		Total 100 Marks

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

CO1	Understand the importance of Additive Manufacturing
CO2	Classify the different AM processes
CO3	Design for AM processes
CO4	Understand the applications of AM
CO5	Apply the AM Processes bio-medical applications

Mapping of course outcomes with program outcomes

POs → COs↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2					1		1				
CO2	2				1	1						
CO3	2	2	2	2	1	1				1		
CO4	2				2							
CO5		2	3		3	2						2

12612PR304	**PROJECT I**	**SE**	**0-0-4**	**10 Credits**
Exam Scheme				
Continuous Assessment		End-Sem Evaluation (OR)		Total

Course Objectives:

1. To understand the open literature

2. To familiarize the students about collection of technical literature, reading and understanding

3. To write problem statement and Objectives

12612PR401	PROJECT-II	PR	0-0-4	20 Credits
Exam Scheme				
Continuous Assessment		End-Sem Evaluation (OR)		Total

Course Objectives:

1. To understand the open literature
2. To familiarize the students about collection of technical literature, reading and understanding
3. To write problem statement and Objectives
4. To Analyze the problem and find probable solution
5. To write the project report