



**Second Year (Semester-IV) B.Tech. Mechanical Engineering**

**BME32425: Smart Manufacturing and Industry 4.0**

<b>Teaching Scheme</b>			<b>Examination Scheme</b>	
<b>Lectures</b>	3Hr/Week		<b>CT</b>	30
<b>Tutorials</b>	-		<b>CA</b>	10
<b>Total Credits</b>	3		<b>ESE</b>	60
			<b>Total</b>	100 Marks

Duration of ESE: 03 Hrs.

**Course Objectives:**

- 1 To provide fundamental knowledge of sensing, actuation, communication, and networking technologies used in Industrial IoT systems.
- 2 To introduce the concepts of Industry 4.0, including smart factories, lean production systems, and connected business models.
- 3 To explain advanced Industry 4.0 technologies such as Cyber-Physical Systems, AI, Big Data analytics, AR/VR, and Product Lifecycle Management
- 4 To develop understanding of Industrial IoT architecture, industrial processes, cybersecurity challenges, and industrial internet systems.
- 5 To Familiarize learners with real-world Industrial IoT applications across manufacturing, healthcare, power plants, process industries, and UAV-based industrial solutions.

<b>Course Contents</b>		<b>Hours</b>
<b>Unit I</b>	<b>Introduction:</b> Sensing & actuation, Communication-Part I, Part II, Networking-Part I, Part II, Industry 4.0: Globalization and Emerging Issues, The Fourth Revolution, LEAN Production Systems, Smart and Connected Business Perspective, Smart Factories.	(7)
<b>Unit II</b>	<b>Industry 4.0:</b> Cyber Physical Systems and Next Generation Sensors, Collaborative Platform and Product Lifecycle Management, Augmented Reality and Virtual Reality, Artificial Intelligence, Big Data and Advanced Analysis.	(7)
<b>Unit III</b>	<b>Cybersecurity in Industry 4.0, Basics of Industrial IoT:</b> Industrial Processes-Part I, Part II, Industrial Sensing & Actuation, Industrial Internet Systems	(7)
<b>Unit IV</b>	<b>Industrial IoT-</b> Application Domains: Healthcare, Power Plants, Inventory Management & Quality Control, Plant Safety and Security (Including AR and VR safety applications), Facility Management.	(7)
<b>Unit V</b>	<b>Industrial IoT-</b> Application Domains: Oil, chemical and pharmaceutical industry, Applications of UAVs in Industries	(7)

Text Books	
T.1	"Industry 4.0: Concepts, Processes and Systems" by Ravi Kant, Hema Gurung.
T.2	"The Concept Industry 4.0" by Bartodziej, Christoph Jan.
T.3	"Smart Manufacturing: Concepts and Case Studies" by Rajesh Kumar Singh, R. K. Garg, and S. T. G. Deshmukh
T.4	"Industry 4.0: The Industrial Internet of Things" by Alasdair Gilchrist.

  

Reference Books	
R.1	"Industry 4.0: Managing the Digital Transformation" by Alp Ustundag and Emre Cevikcan.
R.2	"Industry 4.0 Vision for the Supply of Energy and Materials: Enabling Technologies and Emerging Applications" by Mahdi Sharifzadeh.
R.3	Artificial Intelligence in Manufacturing" edited by S. G. Ponnambalam and Inderdeep Singh.
R4	Robotics and Automation in Manufacturing" by Richard C. Dorf and Thomas F. Kusiak.

Useful Links	
1	<a href="https://nptel.ac.in/courses/106105195">https://nptel.ac.in/courses/106105195</a>
2	<a href="http://www.digimat.in/nptel/courses/video/106105195/L10.html">http://www.digimat.in/nptel/courses/video/106105195/L10.html</a>

	Course Outcomes	CL
BME32425.1	Apply the fundamentals of sensing, actuation, industrial communication, and networking in the context of Industry 4.0 environments.	3
BME32425.2	Interpret the principles of Industry 4.0, smart factories, lean production systems, and their impact on globalization and modern industrial practices.	3
BME32425.3	Summarize the role of Cyber-Physical Systems, next-generation sensors, AI, Big Data analytics, AR/VR, and collaborative platforms in smart manufacturing.	2
BME32425.4	Explain the Industrial IoT architectures, industrial processes, industrial internet systems, and associated cybersecurity requirements.	2
BME32425.5	Understand the Industrial IoT concepts to practical application domains such as healthcare, power plants, inventory and quality management, plant safety, process industries, and UAV-based industrial applications.	2

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Mechanical Engineering (NBA Accredited)  
Tulsiramji Gaikwad Patil College of  
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College Of Engineering  
and Technology, Nagpur



**Second Year (Semester- IV) B.Tech. Mechanical Engineering**

**BME32421: Two and Three-Wheeler Technology**

<b>Teaching Scheme</b>		<b>Examination Scheme</b>	
Lectures	3Hr/Week	CT	30
Tutorials	-	CA	10
Total Credits	3	ESE	60
		Total	100 Marks
			Duration of ESE:03Hrs

**Course Objectives:**

- 1 To provide fundamental knowledge of the construction, layout, and classification of two-wheelers and three-wheelers.
- 2 To enable students to understand the working principles of engines, fuel supply, cooling, and emission systems used in light vehicles.
- 3 To develop competence in analyzing transmission, chassis, suspension, steering, and braking systems of two and three-wheelers.
- 4 To familiarize students with electrical, safety, and control systems to improve vehicle performance and rider safety.

	<b>Course Contents</b>	<b>Hours</b>
<b>Unit I</b>	<b>Introduction and Vehicle Layout:</b> Classification of two-wheelers and three-wheelers, Historical development and market overview (Indian and global scenario), Basic vehicle layout and major systems, Ergonomics, rider comfort, and safety considerations, Vehicle terminology, specifications, and performance parameters	(7)
<b>Unit II</b>	<b>Engine and Fuel Systems:</b> Types of engines used in two and three-wheelers (2-stroke and 4-stroke), Engine construction and working principle, Cooling systems: Air and liquid cooling, Fuel supply systems: Carburetion and fuel injection (EFI), Intake and exhaust systems, Emission formation and basic emission control techniques	(7)
<b>Unit III</b>	<b>Transmission, Chassis, and Suspension Systems:</b> Clutch types and operation, Gearbox and power transmission systems (manual, CVT, belt and chain drives), Frame types and construction, Front and rear suspension systems, Wheels and tyres: Types, construction, and selection, Vehicle stability and handling characteristics	(7)
<b>Unit IV</b>	<b>Braking, Electrical, and Safety Systems:</b> Braking systems: Drum, disc, CBS, and ABS, Steering system and geometry, Electrical systems: Battery, charging, starting, and ignition systems, Safety features and passive/active safety systems	(7)
<b>Unit V</b>	<b>Three-Wheeler Technology and Emerging Trends:</b> Construction and working of three-wheelers, Load distribution and stability in three-wheelers, Powertrain options for three-wheelers, Electric two-wheelers and three-wheelers	(7)

Text Books	
T.1	Two & Three-Wheeler Technology – by K. K. Ramalingam
T.2	A Textbook of Automobile Engineering – by R. K. Rajput
T.3	Automotive Mechanics – by William H. Crouse & Donald L. Anglin
Reference Books	
R.1	Automobile Engineering – by Kirpal Singh
R.2	Automotive Technology – by Jack Erjavec & Rob Thompson
R.3	Internal Combustion Engines – by V. Ganesan

Useful Links	
1	<a href="http://digimat.in/nptel/courses/video/107106088/L01.html">http://digimat.in/nptel/courses/video/107106088/L01.html</a>
2	<a href="https://ed.iitm.ac.in/~shankaram/Course_Files/ED5160/ED5160.htm">https://ed.iitm.ac.in/~shankaram/Course_Files/ED5160/ED5160.htm</a>

	Course Outcomes	CL
BME32421.1	Recognize the classification, layout, components, and regulatory requirements of two-wheelers and three-wheelers.	2
BME32421.2	Describe the construction and working of engines, fuel systems, cooling systems, and emission control techniques used in two and three-wheelers.	2
BME32421.3	Apply transmission systems, chassis design, suspension, wheels, and tires for performance, stability, and ride comfort.	3
BME32421.4	Interpret understanding of braking systems, electrical systems, steering mechanisms, and safety features used in modern vehicles.	3
BME32421.5	Understand three-wheeler technologies and assess emerging trends such as electric vehicles, hybrid systems, and future mobility solutions.	2

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