Department of Mechanical Engineering

Program: B. Tech. (Mechanical)				Semester: V			
Course: Industry 4.0 (Open Elective-II)				Code: BME5602A			
Teaching Scheme				Evaluation Scheme			
Lecture	Practical	Hours	Credit	IE	MTE	ETE	Total
3	--	3	3	20	30	50	100

Prior knowledge:
  a. Basic programming skills
  b. Mathematical skills

Course Objectives:
   1. To introduce revolutions of manufacturing industry
   2. To introduce technological advancement in modern manufacturing industries
   3. To introduce concepts of smart manufacturing, emphasizing Industry 4.0 in manufacturing industries

Course Outcomes:
 After learning this course, the students will be able to:
   1. Correlate the recent manufacturing trends and technological pillars of Industry 4.0.
   2. Apply pillars of Industry 4.0 to the manufacturing industry.
   3. Adapt the changes in existing manufacturing practices and relate the role of industrial robotics and sensors.
   4. Identify applications of AR and VR in smart manufacturing.
   5. Compare eco system of current manufacturing industry and Industry 4.0

Detailed Syllabus:

Unit	Description	Duration (H)
1.	**Industrial revolution and current state of industry:** Overview of industrial revolution, Introduction to Automation, hard automation, soft automation, classification of production system, adaptive control, overview of terminologies like CAD, CAM, CAE, CAPP etc.	04
2.	**Introduction to Industry 4.0:** Introduction to industry 4.0, need for Industry 4.0, Framework for Industry 4.0, technological pillars in industrial 4.0, applications, challenges and scope for industry 4.0	04
3.	**Technological developments in Industry 4.0:** Introduction to Smart Manufacturing, overview of big data and analytic techniques, cyber security, Internet of things (IoT), Industrial Internet of things (IIoT), Cloud computing, artificial intelligence.	08
4.	**Robotics and Sensors:** Introduction to technological components of Robot, classification of sensors and its applications in Manufacturing industry, Role of robots in Industry 4.0, Internet of Robotic Things, Cloud Robotics, and Cognitive Architecture for Cyber-Physical Robotics	08
5.	**Simulation, Augmented Reality and Virtual Reality in Industry 4.0:** Introduction to simulation, methods for simulation of physical processes, interconnectivity using simulation softwares, Introduction to Augmented reality and Virtual reality, classification of AR and VR, Difference between AR and VR, Hardware and Software Technology for AR and VR, Applications of AR and VR	08
6.	**Ecosystem for Industry 4.0:** Economic aspects, opportunities and skills required for industry 4.0, Effects of 4-M	04

B. Tech. (Mechanical Engineering), PCCoE Pune

	Man, Machine, Material and Method in Industry 4.0, current state of industry 4.0 in India	

Text Books:
1. M. P. Groover (2015) Automation, Production Systems, and Computer Integrated Manufacturing, Pearson
2. Leong W., (2020), Nine pillars of technologies for Industry 4.0, IET publishers
3. Gilchrist A., (2016), Industry 4.0, Apress

Reference Books:
1. Alp Ustundag and Emre Cevikcan, "Industry 4.0: Managing the Digital Transformation".
2. Bartodziej, Christoph Jan, "The Concept Industry 4.0".
3. Klaus Schwab, "The Fourth Industrial Revolution".
4. Christian Schröder, "The Challenges of Industry 4.0 for Small and Medium-sized Enterprises".
5. Chua C K, Leong K F, Lim C S, (2012), Rapid Prototyping, World Scientific.

E-sources:
- **www.nptel.ac.in**