Course Code	Course Title	L	T	P	C
BECE312L	Robotics and Automation	3	0	0	3
Pre-requisite	NIL	Syllabus version			
		1.0			

Course Objectives

1. To provide basic understanding of robotics and automation.
2. To demonstrate the need of various sensors and drives in robotic system.
3. To make students understand about the robotic kinematics, path planning and different trajectories.
4. To deliver the programming languages to design robots in practice and research for contemporary use.

Course Outcomes

At the end of the course, students will be able to

1. Classify robots and summaries their role in diverse applications
2. Infer the working of basic electric, electronic, and other types of drives required in robots.
3. Distinguish and interpret the sensors for various applications in robotics and automation.
4. Determine the mathematical model of robotic systems and analyze their kinematic behavior.
5. Design robots for varied working environments encompassing all types of motions across different paths and diverse trajectories.
6. Apply the ideas in performing various robotic tasks for contemporary industry standards using suitable programming skills.

Module:1	Robotics and Automation	5 hours

Robots: Basics, Types-Application, Mobility, D o F , Terrain, components classification, performance characteristics, Industrial Robots, HRI, Automatic assembly system.

Module:2	Drives for Robotics	5 hours

Drives: Electric, hydraulic and pneumatic drives.

Module:3	Sensors for Robots	7 hours

Tactile sensors - Proximity and range sensors – Optical Sensor- limit switch sensor- surface array sensor- Acoustic sensors - Vision sensor systems – Vision feedback system -Image processing and analysis - Image data reduction – Segmentation – Feature extraction -Object recognition.

Module:4	Robot Kinematics and Dynamics	10 hours

Kinematics of manipulators, rotational, translation and transformation Homogeneous, Transformations, Denavat – Hartenberg Representation, Inverse Kinematics. Linearization of Robot Dynamics – State variable continuous and discrete models.

Module:5	Path Planning	5 hours

Types of trajectories, trajectory planning and avoidance of obstacles, path planning, skew motion, joint integrated motion and straight line motion.

Module:6	Programming of Robots	5 hours

Robot programming: ROS1 and ROS2, languages and software packages- MATLAB/Simulink, OpenRDK, Adams.

Module:7	Application of Robots	6 hours

Industrial robots used for welding, painting and assembly, remote controlled robots, robots for nuclear, thermal and chemical plants, industrial automation, typical examples of automated Industries, Humanoid robots, medical robots, under water robots, drones.		
Module:8	**Contemporary Issues**	**2 hours**
	Total Lecture hours:	**45 hours**

Text Book(s)	
1.	Kevin M. Lynch, Frank C. Park, "Modern Robotics- Mechanics, Planning, and Control", 2017, Cambridge University Press.
Reference Books	
1.	R. K. Mittal, I. J. Nagrath, "Robotics and Control", 2017, McGraw Hill Education, India,
2.	Ramkumar Gandhinathan, Lentin Joseph, "ROS Robotics Projects-Build and Control Robots Powered by the Robot Operating System, Machine Learning, and Virtual Reality", 2019, Packt Publishing.
3.	Hutchinson, S., Spong, M. W., Vidyasagar, M. "Robot Modeling and Control", 2020, Wiley publications, United Kingdom.
4.	Pawlak, A. M. Sensors and Actuators in Mechatronics: Design and Applications, 2017, CRC Press, United Kingdom.
5.	Lentin Joseph, "Robot Operating System (ROS) for Absolute Beginners - Robotics Programming Made Easy, 2018, Apress.

Mode of Evaluation: Continuous Assessment Test, Digital Assignment, Quiz and Final Assessment Test

Recommended by Board of Studies	28-02-2023		
Approved by Academic Council	No. 69	Date	16-03-2023