22ECPE611	ROBOTICS	SEMESTER VI

PREREQUISITES	CATEGORY	PE	Credit		3
	Hours/Week	L	T	P	TH
		3	0	0	3

Course Objectives:

1. To understand the functions of the basic components of a Robot.
2. To study the use of various types of End of Effectors and Sensors
3. To impart knowledge in Robot Kinematics and Programming
4. To learn Robot safety issues and economics.

Unit I	FUNDAMENTALS OF ROBOT	9	0	0	9

Robot - Definition - Robot Anatomy - Coordinate Systems, Work Envelope Types and Classification- Specifications-Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load- Robot Parts and their Functions-Need for Robots-Different Applications.

Unit II	ROBOT DRIVE SYSTEMS AND END EFFECTORS	9	0	0	9

Pneumatic Drives-Hydraulic Drives-Mechanical Drives-Electrical Drives-D.C. Servo Motors, Stepper Motors, A.C. Servo Motors-Salient Features, Applications and Comparison of all these Drives, End Effectors-Grippers-Mechanical Grippers, Pneumatic and Hydraulic- Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations.

Unit III	SENSORS AND MACHINE VISION	9	0	0	9

Requirements of a sensor, Principles and Applications of the following types of sensors- Position sensors - Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders, pneumatic Position Sensors, Range Sensors Triangulations Principles, Structured, Lighting Approach, Time of Flight, Range Finders, Laser Range Meters, Touch Sensors ,binary Sensors., Antilog Sensors, Wrist Sensors, Compliance Sensors, Slip Sensors, Camera, Frame Grabber, Sensing and Digitizing Image Data- Signal Conversion, Image Storage, Lighting Techniques, Image Processing and Analysis-Data Reduction, Segmentation, Feature Extraction, Object Recognition, Other Algorithms, Applications- Inspection, Identification, Visual Serving and Navigation.

Unit IV	ROBOT KINEMATICS AND ROBOT PROGRAMMING	9	0	0	9

Forward Kinematics, Inverse Kinematics and Difference; Forward Kinematics and Reverse Kinematics of manipulators with Two, Three Degrees of Freedom (in 2 Dimension), Four Degrees of freedom (in 3 Dimension) Jacobians, Velocity and Forces-Manipulator Dynamics, Trajectory Generator, Manipulator Mechanism Design-Derivations and problems. Lead through Programming, Robot programming Languages-VAL Programming-Motion Commands, Sensor Commands, End Effectors commands and simple Programs.

Unit V	IMPLEMENTATION AND ROBOT ECONOMICS	9	0	0	9

RGV, AGV; Implementation of Robots in Industries-Various Steps; Safety Considerations for Robot Operations - Economic Analysis of Robots.

Total (45L)= 45 Periods

Text Books:

1. Klafter R.D., Chmielewski T.A and Negin M., “Robotic Engineering - An Integrated Approach”, Prentice Hall, 2003.
2. Groover M.P., “Industrial Robotics -Technology Programming and Applications”, McGraw Hill, 2001.

Reference Books:

1. Craig J.J., “Introduction to Robotics Mechanics and Control”, Pearson Education, 2008
2. Deb S.R., “Robotics Technology and Flexible Automation” Tata McGraw Hill Book Co., 1994.
3. Koren Y., “Robotics for Engineers", Mc Graw Hill Book Co., 1992.

4.	Rajput R.K., "Robotics and Industrial Automation", S.Chand and Company, 2008

E-References:	
1.	https://nptel.ac.in/courses/112105249
2.	https://nptel.ac.in/courses/112105236
3.	https://www.youtube.com/watch?v=7Bahzh3rniw

Course Outcomes: Upon completion of this course, the students will be able to		**Bloom's Taxonomy Mapped**
CO1	The students can able to apply the basic engineering knowledge for the design of robotics.	L1, L2
CO2	Apply the knowledge on robot drive systems and end effectors.	L2, L4
CO3	Have the knowledge on Sensors and meters	L2, L4
CO4	Able to apply the Robotic kinematic and VAL Programming	L4, L5
CO5	Implement the robotics on economics and safety.	L3, L6

COURSE ARTICULATION MATRIX

COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO2**	**PSO3**
CO1	1	2	1	1	1								1		
CO2	2	1	2	2	1		1					1	2	1	
CO3	2	2	1	2	2		1					1	2	2	2
CO4	2	3	2	3	3	1	2	1				2	2	2	
CO5	3	3	2	3	3	1	2	2	1	1	3	3	3	2	3
Avg	2	2.2	1.6	2.2	2	0.4	1.2	0.6	0.2	0.2	0.6	1.4	2	1.4	1
3/2/1 - indicates strength of correlation (3-High,2- Medium,1- Low)															