LESSON PLAN

Class: T.E. Production
Academic Term: Jan-Apr 2019
Course: Robotics

Faculty Member: Prof. D.S.S. Sudhakar/ Prof. Saurabh Korgaonkar

Course Objectives:

1. To acquaint with the significance of robot system in agile and automated manufacturing processes.
2. To make conversant with robotic element / peripherals, their selection and interface with manufacturing equipments.
3. The learner will be able to understand the basics of robot kinematics.
4. Will be able to understand the basics of robotic vision.

Periods (Hours) per week:

Lecture: 3 Practical: 0

University Evaluation Method:

Theory examination: 80 Marks (3 Hrs)
Internal Assessment: 20 Marks
Term work: 0 Marks
Total: 100 Marks

Mapping of CO's to PO's:

CO# / PO#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CourseCode.1	2	0	2	0	0	0	0	0	0	0	0	0	2	2
CourseCode.2	2	2	2	0	2	0	0	0	0	0	0	0	2	2
CourseCode.3	2	2	2	0	2	0	0	0	0	0	0	0	2	2
CourseCode.4	2	2	2	0	2	0	0	0	0	0	0	0	2	2

CO Attainment Scheme:

COURSE OUTCOME	MEASUREMENT FORMULA
CourseCode.1	**CO1 through Direct Assessment (=0.3*test1 + 0.3*assign1 +0.4* university result)+CO1 through InDirect Assessment (=1*course exit survey)**
CourseCode.2	**CO2 through Direct Assessment (=0.2*test 1+ 0.2*assign2+0.2*assign3 +0.4* university result)+**

	CO2 through InDirect Assessment (=1*course exit survey)
CourseCode.3	CO3 through Direct Assessment (=0.3*test2 + 0.3*assign 4+0.4* university result)+CO3 through InDirect Assessment (=1*course exit survey)
CourseCode.4	CO4 through Direct Assessment (=0.2*test2 + 0.2*assign5+0.2*assign6 +0.4* university result)+ CO4 through InDirect Assessment (=1*course exit survey)

Syllabus :

Module	Contents	Hrs.
01	**Introduction** Automation, robotics, Robotic system & Anatomy, Classification and Future Prospects.	02
02	**2.1 Drives** Control Loops, Basic Control System Concepts & Models, Control System Analysis, Robot Activation & Feedback Components, Position & Velocity Sensors, Actuators and Power Transmission system. **2.2 Robot & its Peripherals** **2.3 End Effecters:** Type mechanical and other grippers, Tool as endeffecter. **Sensors:** Sensors in Robotics, Tactile Sensors, Proximity & Range Sensors, Sensor Based Systems, Vision systems and Equipment. Introduction to the Microcontroller (Arduino) and interfacing with a sensor	10
03	**3.1 Machine vision** Introduction, Low level & High level Vision, Sensing & Digitizing, Image Processing & analysis, Segmentation, Edge detection, Object Description & recognition, interpretation and Applications. **3.2 Programming for Robots** Method, Robot Programme as a path in space, Motion interpolation, motion & task level Languages, Robot languages, Programming in suitable languages and characteristics of robot.	10
04	**4.1 Robot Kinematics** Forward, reverse & Homogeneous Transformations, Manipulator Path control and Robot Dynamics.	08
05	**5.1 Root Intelligence & Task Planning** **Introduction, State space search, Problem reduction, use of predictive Logic, Means. Ends Analysis, Problem solving, Robot learning and Robot task planning.**	07
06	**6.1 Robot application in manufacturing** **Material transfer, machine loading & un loading, processing operation, Assembly & inspectors, robotic Cell design & control, Social issues & Economics of Robotics.**	06

Lesson Plan:

Week	Date	Duration (Hrs.)	Topic	*Method of Teaching	Remarks (If Any)
1	2/1/2019	1	Introduction to robotics	PPT	
	4/1/2019	1	Robotic systems and anatomy,	PPT	
	7/1/2019	1	Classification of robots	PPT	
2	9/1/2019	1	Future prospects	PPT	
	11/1/2019	1	Drives	PPT	
	14/1/2019	1	Control loops, basic control system & Control Models	BLACKBOARD	
3	16/1/2019	1	Control system analysis	BLACKBOARD	
	18/1/2019	1	Robot activation & Feedback Components	BLACKBOARD	
	21/1/2019	1	Actuators & Power transmission systems	PPT	
4	23/1/2019	1	End-Effectors & their different uses	PPT	
	25/1/2019	1	Sensors	PPT, MINI PROJECT	
	28/1/2019	1	Sensors based systems	PPT,MINI PROJECT	
5	30/1/2019	1	Vision equipment	PPT	
	1/2/2019	1	Machine vision -> Introduction and Classification between high and low level vision	PPT, MATLAB	
	8/2/2019	1	Sensing and Digitizing	PPT, MATLAB	
6	11/2/2019	1	Image processing & analysis	PPT, MATLAB	

	18/2/2019	1	Edge detection	PPT, MATLAB	
	20/2/2019	1	Template matching	PPT, MATLAB	
7	22/2/2019	1	Applications	PPT, MATLAB	
	25/2/2019	1	Robot kinematics -> Direct kinematics	BLACKBOARD	
8	27/2/2019	1	Direct kinematics of 2 DOF and 3 DOF robot arm	BLACKBOARD	
	1/3/2019	1	Direct kinematics of SCARA robot	BLACKBOARD	
	6/3/2019	1	Direct kinematics of 6 DOF robot	BLACKBOARD	
9	8/3/2019	1	Inverse kinematics	BLACKBOARD	
	11/3/2019	1	Inverse kinematics examples	BLACKBOARD	
	13/3/2019	1	Robot intelligence and task planning introduction	BLACKBOARD	
10	15/3/2019	1	State space search	BLACKBOARD	
	18/3/2019	1	Robot learning	BLACKBOARD	
	20/3/2019	1	Robot task planning	BLACKBOARD	
11	22/3/2019	1	Robot trajectory planning	BLACKBOARD	
	25/3/2019	1	Robots cell design	BLACKBOARD	
	27/3/2019	1	Robotic application in manufacturing	PPT	
12	29/3/2019	1	Social issues and Economics of Robotics	PPT	
	1/4/2019	1	Sensors- Mini Project Presentation	PPT	
	3/4/2019	1	Sensors- Mini Project Presentation	PPT	

* Methods of Teaching include but are not limited to following list:

- ✔ Lecture
- ✔ Demonstration
- ✔ Models
- ✔ PPTs
- ✔ Simulations and Animations
- ✔ Case Studies
- ✔ Mini Projects

* Method of Conducting Practicals / Tutorials include but not limited to:

- ✔ Experiments
- ✔ Assignments
- ✔ Presentations
- ✔ Mini Project

Curricullum Gap : NONE

Reference Books:

1. *Industrial Robotics, Technology, Programming & Applications*, Grover, Weiss, Nagel, Ordey, Mc Graw Hill.
2. *Robotics: Control, Sensing, Vision & Intelligence,* Fu, Gonzalex, Lee, Mc Graw Hill.
3. *Robotic technology & Flexible Automation,* S R Deb. TMH.
4. *Robotics for Engineers,* Yoram Koren , Mc Graw hill.
5. *Fundamentals of Robotics,* Larry Health.
6. *Robot Analysis & Control*, H Asada, JJE Slotine.
7. *Robot Technology,* Ed. A Pugh, Peter Peregrinus Ltd. IEE, UK.
8. *Handbook of Industrial Robotics,* Ed. Shimon.John Wiley.