SCHEME OF COURSE WORK

Course Details:

Course Title	: INDUSTRIAL ROBOTICS		
Course Code	: 13ME2114	**L T P C**	**: 4 0 0 3**
Program:	: M.Tech.		
Specialization:	: CAD/CAM		
Semester	: II		
Prerequisites	: ROBOTICS		
Courses to which it is a prerequisite	: AUTOMATION IN MANUFACTURING		

Course Outcomes (COs):

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

1. analyze the manipulator design including actuator, drive and sensor issues
2. calculate the forward kinematics, inverse kinematics and Jacobian for serial and parallel robots
3. identify different types of end effectors and sensors required for specific applications
4. develop programming principles and languages for a robot control system
5. discuss various applications of industrial robot systems

Program Outcomes (POs)

At the end of the program, the students in CAD/CAM will be able to
1. acquire fundamentals in the areas of computer aided design and manufacturing
2. apply innovative skills and analyze computer aided design and manufacturing problems critically
3. identify, formulate and solve design and manufacturing problems
4. carry out research related to design and manufacturing
5. use existing and recent CAD/CAM software
6. collaborate with educational institutions, industry and R&D organizations in multidisciplinary teams
7. apply project and finance management principles in engineering projects
8. prepare technical reports and communicate effectively
9. engage in independent and life-long learning and pursue professional practice in their specialized areas of CAD/CAM
10. exhibit accountability to society while adhering to ethical practices
11. act independently and take corrective measures where necessary

Course Outcome versus **Program Outcomes:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	M	M	S	S							
CO-2			S	S							
CO-3		M	S	S			M				
CO-4			S	S	S		M		M		
CO-5			S	S	S				S		S

S - Strongly correlated, *M - Moderately* correlated, *Blank - No correlation*

Teaching-Learning and Evaluation

Week	TOPIC / CONTENTS	Course Outcomes	Sample questions	TEACHING-LEARNING STRATEGY	Assessment Method & Schedule
1	Introduction: Automation and robotics, Robot anatomy, Robot configuration motions	CO-1	Explain the difference between automation and robotics?	▫ Lecture ▫ Demo class	
2	Robot drive systems, Control systems and dynamic performance, precision of movement	CO-1	Discuss in brief about the control systems and dynamic performance of a robot?	▫ Lecture ▫ Discussion	
3	Controllers, control system analysis, Robot activation and feedback components	CO-1	Explain the types of controllers and analysis of a controller?	▫ Lecture ▫ Discussion	
4	Position sensors, velocity sensors, actuators, power transmission systems	CO-2 & CO-3	Differentiate between position and velocity sensors?	▫ Lecture ▫ Discussion	
5	Motion analysis and control: Manipulator kinematics	CO-2 & CO-3	Explain the analysis of Manipulator kinematics of a robot?	▫ Lecture ▫ Discussion ▫ Problem solving	
6	Position representation - forward transformation, homogenous transformations	CO-3	What is meant by a forward transformation and a homogenous transformation?	▫ Lecture ▫ Discussion ▫ Problem solving	
7	Manipulator path control - robot dynamics,	CO-1 & CO-3	Explain in brief about dynamics of a robot with necessary equations?	▫ Lecture ▫ Discussion	**Case study- 1 (Week 7)**
8	Configuration of a robot controller	CO-1	Draw the sketch of configuration of a robot controller?	▫ Lecture ▫ Discussion	**Seminar - 1 (Week 8)**
9	**Mid-Test 1**				**Mid-Test 1 (Week 9)**
10	End effectors: Grippers-types, operation, mechanism, force analysis	CO-2 & CO-3	Write about the types and operations produced by a gripper?	▫ Lecture ▫ Discussion ▫ Problem solving	
11	Tools as end effectors, considerations in gripper selection and design	CO-2 & CO-3	Explain the considerations in gripper selection and design?	▫ Lecture ▫ Discussion	
12	Sensors: Desirable features, tactile, proximity and range sensors, uses of sensors in robotics	CO-2	Write about the uses of sensors in robotics?	▫ Lecture ▫ Discussion ▫ Problem solving	
13	Machine vision: Functions and robotics applications in machine vision systems	CO-2 & CO-3	Explain the functions and applications of a machine vision system with a neat sketch?	▫ Lecture	
14	Robot programming and Languages, WAIT, SIGNAL and DELAY commands	CO-4	Write about the languages used for robot programming?	▫ Lecture ▫ Discussion	
15	Robot language structures, elements in functions.	CO-4	Draw the structure of a robot language system by showing their elements?	▫ Lecture ▫ Discussion	
16	Robot cell design and control: types and its functions, considerations in work cell design	CO-5	Explain the considerations in work cell design?	▫ Lecture ▫ Discussion	**Case study – 2 (Week 16)**
17	Robot applications: material transfer, machine-loading/unloading, processing operations, assembly and inspections	CO-4 & CO-5	Write about the robot applications used for assembly and inspection?	▫ Lecture ▫ Discussion	**Seminar - 2 (Week 17)**

18	**Mid-Test 2**				**Mid-Test 2 (Week 18)**
19/20	**END EXAM**				**END EXAM**