SCHEME OF COURSE WORK

Course Title	ROBOTICS		
Course Code	19ME2107	L T P C	: 3 0 0 3
Program:	: M.Tech.		
Specialization:	: CAD/CAM		
Semester	: I		

Course Outcomes (COs):

1	Analyze the manipulator design including selection of gripper
2	Evaluate kinematics and dynamics for serial and parallel robots
3	Classify different control schemes and identify applications of sensors in robotics
4	Explain image processing in robot vision system and types of robot programming languages
5	Design a robot work cell layout and discuss applications of 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	PO12
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*

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.	CO1	1. Identify the difference between automation and robotics. 2. Explain the robot anatomy, configuration, work volume, drive and control systems. 3. Design and analyze grippers.	Lectures ROBOANALYZER Mitsudishi robot programming software MATLAB, PPT, Seminar	Seminar (week 3-7)
2	Robot configurations, work volume, robot drive systems,	CO1			
3	Control systems and precision of movement.	CO1			
4	Robot end-effectors: Grippers-types, operation, mechanism, force analysis, tools as end-effectors and considerations in gripper selection and design	CO1			
5	Robot kinematics: Forward and inverse kinematics for RR & RP serial robots and parallel robots (planar four bar mechanism and three DOF parallel manipulator).	CO2	1.Explain the concepts of manipulator kinematics and dynamics. 2.Solve forward and inverse kinematics for simple robots. 3.Solve manipulator dynamic problems using Lagrangian formulation.	Lectures , ROBOANALYZER Mitsudishi robot programming software MATLAB, PPT, Seminar	
6	Robot dynamics: Dynamics-Lagrangian formulation for RR & RP serial and planar robots, trajectory planning joint space techniques and Cartesian space techniques.	CO2			
9	Mid-Test 1	CO-1, CO-2			

10	Control of Manipulators: Basic control system concepts and models, manipulator control problem, linear control schemes, PD, PID and CTC schemes, force control of robotic manipulators	CO3	1.Explain the basic concepts of robot controlling systems. 2. Describe PD and PID control schemes. 3. Select the types of sensors and actuators used in robotics.	Lectures , ROBOANALYZER Mitsudishi robot programming software MATLAB, PPT, Seminar	Seminar (week 11-16)
11	Robot Sensors and Actuators: Desirable features of tactile, proximity and range sensors, uses of sensors in robotics robot sensors and actuators position sensors, velocity sensors, actuators and power transmission systems.	CO3			
12	Robotic vision: Process of imaging, architecture of robotic vision system, image acquisition, image representation, image processing.	CO4	1. . Explain the concept of image enhancement, segmentation and transformation. 2. Describe the requirements and features of robot programming. 3. Explain the various methods of robot programming.	Lectures , ROBOANALYZER Mitsudishi robot programming software MATLAB, PPT, Seminar	
13	Robot programming and languages: Lead through programming, robot programming as a path in space, motion interpolation, WAIT, SIGNAL and DELAY commands,	CO4			
14	Branching, capabilities and limitations of lead through methods, textual robot languages, generations, robot language structure and motion commands.	CO4			
15	Robot cell design and control: Robot cell layouts-robot centered cell, inline robot cell, mobile robot cell,	CO5	1. Design a robot cell for simple manufacturing system 2. Explain the concepts of work cell control, inter locks and error detection 3. Explain various industrial applications of robotics	Lectures , ROBOANALYZER Mitsudishi robot programming software MATLAB, PPT, Seminar	
16	Considerations in work design, work cell control, inter locks, errors detection, work cell controller	CO5			
17	Robot applications: Industrial applications material handling, processing applications, assembly and inspection applications, nonindustrial applications	CO5			
18	Mid-Test 2	CO-3, CO-4, CO-5			
19/20	END EXAM	All Cos			