ROBOTICS

Programme: B. Tech **Year: 3rd** **Semester: VI**

Course: Elective **Credits: 3.0** **Hours: 40(L)**

Course Context and Overview (100 words):

This is a program elective course offered to 3rd year Mechanical-Mechatronics Engineering students. It covers the study of kinematics and dynamics of both manipulators and mobile robots. This course presents an introduction to the fundamentals of manipulators and mobile robotics, spanning the mechanical, motor, sensory, perceptual and cognitive layers that comprise this field of study.

Prerequisites Courses:

Basic Electronics, Electrical Technology, Industrial Measurements, Mechatronics.

Course outcomes (COs):

On completion of this course, students will be able to:		Units
CO1	Understand the basic components of robots.	Unit 1,2
CO2	Model forward and inverse kinematics of robot manipulators.	Unit 3,4,5
CO3	Analyze forces in links and joints of a robot	Unit 3,4,5
CO4	Design intelligent robots using sensors.	Unit 4,5
CO5	Program a robot to perform tasks in industrial applications.	Unit 6,7

Text Books:

[1] John Craig, *Introduction to Robotics: Mechanics and Control,* Pearson/Prentice Hall Education, 3rd Edition, 2005

[2] R. Siegwart, *et.al Introduction to Autonomus Mobile Robots*, Prentice Hall of India, 3rd Edition, 2005.

Reference Books:

[1] Richard D. Klafter, *Robotics Engineering, An Integrated approach*, Prentice Hall of India, 3rd Edition, 2003.
[2] Fu K S, Gomalez R C and Lee C S G, *Robotics: Control, Sensing, Vision and Intelligence*, McGraw Hill Book Company, 1st Edition, 1987.
[3] Mittal, R. K., and I. J. Nagrath. *Robotics and control*. Tata McGraw-Hill, 2003.

Additional Resources:

NPTEL, MIT Video Lectures, Web Resources etc.

Course Module:

Units	Course Topics	Hours	Outcome
Unit 1	**Fundamental Concepts of Robotics**	**2**	Skill Development
	History, present status and future trends in Robotics. Laws of Robotics, Robot definitions, Robotics systems and Robot anatomy. Specification of Robots - resolution, repeatability and accuracy of a manipulator. Robotic applications. Cobotics.		
Unit 2	**Grippers and Manipulators**	**2**	Employability
	Gripper joints, Gripper force, Serial manipulator, Parallel Manipulator, selection of Robot-Selection based on the Application.		
Unit 3	**Manipulator Kinematics and Dynamics**	**15**	Skill Development
	Manipulators Kinematics, Rotation Matrix, Homogenous Transformation Matrix, Direct and Inverse Kinematics for industrial robots for Position and orientation. Motion generation, Manipulator dynamics, Jacobean in terms of D-H matrices. Differential Kinematics and static-Dynamics-Lagrangian Formulation, Newton-Euler Formulation for RR & RP Manipulators		

Unit 4	**Mobile Robotics**	**10**	Skill Development
	Introduction, legged and wheeled mobile robots Mobile robot kinematics Introduction to localization, planning and navigation		
Unit 5	**Control Architecture**	**4**	Employability
	position, path velocity and force control systems, computed torque control, adaptive control, and Servo system for robot control		
Unit 6	**Programming of Robots and Vision System**	**5**	Employability
	overview of various programming languages		
Unit 7	**Application of Robots in production systems**	**2**	Skill Development
	Application of robot in welding, machine tools, material handling, and assembly operations parts sorting and parts inspection.		

Evaluation Methods:

Evaluation criteria will be shared by the concerned course instructor.

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