SWARNANDHRA COLLEGE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
Narsapur, West Godavari District, A.P. 534280
DEPARTMENT OF ROBOTICS

TEACHING PLAN

Course Code	Course Title	Semester	Branches	Contact Periods /Week	Academic Year	Date of commencement of Semester
23RB5T01	Robot Kinematics and Dynamics	V	Robotics	5	2025-2026	09.07.2025

COURSE OUTCOMES		
CO1:	Describe the fundamentals of robotic systems, including components, degrees of freedom, and coordinate transformations.	K2
CO2:	Apply transformation matrices and coordinate frames to represent the position and orientation of robotic links.	K3
CO3:	Perform direct kinematic analysis for SCARA and articulated robots using D-H parameters.	K3
CO4:	Analyze and solve inverse kinematics problems for multi-axis robotic manipulators.	K4
CO5:	Analyze dynamic equations of robotic manipulators using Newton–Euler and Lagrangian formulations.	K4
CO6:	Apply joint and Cartesian space techniques to plan trajectories for pick-and-place operations.	K3

Unit	Course Outcome	Topic No	Topic/Activity	Text Book / Refference	Contact Hour	Delivery Method
I	Unit - I - Introduction					
	Describe the fundamentals of robotic systems, including components, degrees of freedom, and coordinate transformations. (CO1) & Apply transformation matrices and coordinate frames to represent the position and orientation of robotic links. (CO2)	1.1	Introduction, Components of a robotic system	T1, T3/R3	1	Chalk & Talk, PPT, Videos Tutorials
		1.2	Degrees of Freedom, Classification of robots	T1, T3/R3	1	
		1.3	position and orientation of objects	T1, T3/R3	2	
		1.4	objects coordinate frame Rotation matrix	T1, T3/R3	2	
		1.5	Euler angles	T1, T3/R3	2	
		1.6	Roll, pitch and yaw angles	T1, T3/R3	2	
		1.7	Coordinate Transformations, coordinate frames	T1, T3/R3	2	
		1.8	Rotations, Homogeneous coordinates	T1, T3/R3	1	
		1.9	Joints, end effectors, grippers.	T1, T3/R3	1	
		Total			14	

II	**Unit - II - Direct Kinematics**					
	Perform direct kinematic analysis for SCARA and articulated robots using D-H parameters.	2.1	Link coordinates	T1, T3/R3	1	Chalk & Talk, PPT, Videos Tutorials
		2.2	D-H Representation,	T1, T3/R3	2	
		2.3	The ARM equation.	T1, T3/R3	2	
		2.4	Direct kinematic analysis for Four axis,	T1, T3/R3	2	
		2.5	SCARA Robot and	T1, T3/R3	2	
		2.6	Three axis Articulated Robots.	T1, T3/R3	1	
		2.7	Five axis Articulated Robots.	T1, T3/R3	2	
		2.8	Six axis Articulated Robots.	T1, T3/R3	1	
		Total			**13**	
III	**Unit -III - Inverse Kinematics**					
	Analyze and solve inverse kinematics problems for multi-axis robotic manipulators.	3.1	The inverse kinematics problem	T1, T3/R3	2	Chalk & Talk, PPT, Videos Tutorials
		3.2	General properties of solutions.	T1, T3/R3	2	
		3.3	Tool configuration,	T1, T3/R3	1	
		3.4	Inverse kinematics of four axis SCARA robot	T1, T3/R3	2	
		3.5	Three axis Articulated robot	T1, T3/R3	2	
		3.6	Five axis Articulated robot	T1, T3/R3	2	
		Total			**11**	
IV	**Unit -IV - Robot Dynamics**					
	Analyze dynamic equations of robotic manipulators using Newton–Euler and Lagrangian formulations.	4.1	Inertia of a link	T1, T3/R3	2	Chalk & Talk, PPT, Videos Tutorials
		4.2	Recursive formulation of Dynamics using Newton-Euler equation	T1, T3/R3	3	
		4.3	Equation of 2R and 3R manipulators Using Lagrangian	T1, T3/R3	3	
		4.4	Equation of 2R and 3R manipulators Using Newton-Euler Formulations.	T1, T3/R3	2	
		Total			**10**	
V	**Unit: V -Trajectory Planning**					
	Apply joint and Cartesian space techniques to plan trajectories for pick-and-place operations.	5.1	Workspace Analysis,	T1, T3/R3	1	Chalk & Talk, PPT, Videos Tutorials
		5.2	Work envelope of a Four axis SCARA robot	T1, T3/R3	1	
		5.3	Five axis articulated robot	T1, T3/R3	1	
		5.4	Workspace fixtures,	T1, T3/R3	1	
		5.5	The pick and place operations,	T1, T3/R3	2	
		5.6	Joint space technique – continuous path motion,	T1, T3/R3	2	
		5.7	Interpolated motion,	T1, T3/R3	1	
		5.8	Straight line motion	T1, T3/R3	1	
		5.9	Cartesian space technique in trajectory planning.	T1, T3/R3	2	
		Total			**12**	

CUMULATIVE PROPOSED PERIODS	Total	60	

Text Books:	
1	Robert J. Schilling, Fundamentals of Robotics Analysis and Control, PHI, 2011.
2	John J. Craig, Introduction to Robotics: Mechanics and Control, Pearson, 4th Ed., 2018.
3	Niku S.B., Introduction to Robotics, Prentice Hall, 3rd Editon,2024
Reference Books:	
1	Richard D. Klafter et al., Robotics Engineering, Prentice Hall.1989
2	Saha S.K, Introduction to Robotics, Tata McGraw Hill. 3rd edition,2024.
3	Groover M.P., Industrial Robotics, Tata McGraw Hill, 2nd Edition, 2017.
Web Details	
1	https://onlinecourses.nptel.ac.in/noc20_me53/preview
2	https://crescent.education/wp-content/uploads/2018/08/Robot-kinematics-and-dynamics.pdf
3	https://www.youtube.com/watch?v=LqRg4HmHssc&list=PL2idcbvRB1CN0GlPI2ZVlZAjracsYzgNn

		Name	Signature with Date
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iv.	Programme Coordinator	Dr. FRANCIS LUTHER KING.M	

PRINCIPAL