DEPARTMENT OFMECHANICAL ENGINEERING
Kinematics and Dynamics of Robotics (Open Elective-II)
(Stream: Robotics)
SYLLABUS FOR B.E. IV – SEMESTER

L:T:P (Hrs./week) : 3:0:0	SEE Marks : 60	Course Code: U23OE410ME
Credits : 3	CIE Marks : 40	Duration of SEE : 3 Hours

COURSE OBJECTIVE	COURSE OUTCOMES
The objective of the course is to	On completion of the course, students will be able to
To develop the fundamental knowledge and skills required to analyze, design and control robotic systems	1. Analyze the kinematics of robotic systems and apply them to solve real world problems 2. Apply differential kinematics and statics concepts to design and control robotic systems 3. Analyze the dynamics of serial manipulators using lagrangian method. 4. Analyze the dynamics of serial manipulators using lagrangian and Newton-Euler mechanics 5. Generate and analyze robot trajectories for various applications

CO-PO and CO-PSO mapping															
CO	PO mapping												PSO mapping		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	2			2			2	2		2	3	2	1
CO2	2	2	2			2			2	2		2	3	2	1
CO3	3	3	3			3			3	3		2	3	2	1
CO4	3	2	2		3	3		3	2	2	3	3	3	2	1
CO5	2	2	2		2	2		2	2	2	2	2	3	2	1

UNIT-I
Robot Kinematics
Forward Kinematics: Forward/direct kinematic analysis of serial manipulators.
Inverse Kinematics: General properties of inverse kinematic solution. Inverse kinematics of serial RR planar manipulators.

UNIT-II
Differential Kinematics
Linear and angular velocity of links, Velocity propagation, Manipulator Jacobian for serial manipulators, Jacobian Singularities.

UNIT-III
Static Analysis: Force and moment balance, Jacobian in statics.
Dynamics of serial manipulators
Lagrangian formulation for equations of motion for RP, RR serial manipulators,

Unit-IV
Dynamics of serial manipulators
Recursive dynamics using Newton-Euler formulation of RP and RR serial manipulator.

UNIT-V
Trajectory Generation
Joint-Space Techniques: Cubic Polynomial Trajectories, Linear Segments with Parabolic Blends-without and with via points
Cartesian-Space Techniques: Straight line path, Circular Path, Position Planning, Orientation Planning.
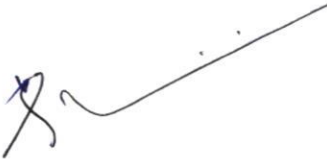
Learning Resources:

1. Bruno Siciliano, Lorenzo Sciavicco, Luigi Villani, Giuseppe Oriolo, "Robotics: Modelling, Planning and Control", Springer Science & Business Media, 2010.
2. M.W.Spong and M.Vidyasagar,"Robot Dynamics and Control", 1st Edition, John Wiley and sons,1990.
3. R.K.Mittal and I.J.Nagrath, "Robotics and Control", Tata McGraw-Hill, 2003.
4. Subir Kumar Saha, "Introduction to Robotics", Tata McGraw-Hill Education, 2014.
5. Howie M. Choset, Seth Hutchinson, Kevin M. Lynch, "Principles of Robot Motion: Theory, Algorithms, and Implementation", MIT Press, 2005.

The break-up of CIE: Internal Tests+ Assignments + Quizzes

1	No. of Internal Tests:	02	Max. Marks for each Internal Test:	30
2	No. of Assignments:	03	Max. Marks for each Assignment:	05
3	No. of Quizzes:	03	Max. Marks for each Quiz Test:	05

Duration of Internal Test: 90 Minutes

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