GUJARAT TECHNOLOGICAL UNIVERSITY

Minor Degree – Robotics
Subject Code : N116AO01

Semester – 6 (w.e.f. AY 2025-26)
Subject Name : Control of Robotic Systems

Prerequisite : Nil

Rationale : This course aims to develop the understanding of control systems, its designing and application in robot systems.

Teaching and Examination Scheme :

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	0	3	70	-	-	-	70

Content :

Sr. No.	Content	Total Hrs
1	**Basics of Control:** Differential Equation, Transfer function, Frequency response, Routh-Hurwitz test, relative stability, Root locus design, construction of root loci, phase lead and phase-lag design, lag-lead design, Bode, polar, Nyquist plot.	**12**
2	**Linear Control:** Concept of states, state space model, different form, controllability, observability; pole placement by state feedback, observer design, P, PI & PID Controller, control law partitioning, modelling and control of a single joint.	**11**
3	**Non-Linear Control System:** Common physical non-linear system, phase plane method, system analysis by phase plane method, stability of non-linear system, stability analysis by describing function method, Liapunov's stability criterion, the control problems for manipulators.	**10**
4	**Motion Control**: Point to Point Control, trajectory generation, Continuous Path Control, Joint based control, Cartesian Control, Force Control, hybrid position/force control system.	**08**

Suggested Specification table with Marks (Theory) :

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20	**20**	**30**	**20**	**5**	**5**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books :

1. M. Gopal, Control Systems, McGraw-Hill (2012)
2. K. Ogata, "Modern Control Engineering", Prentice Hall India (2009).
3. M. Spong, M. Vidyasagar, S. Hutchinson, Robot Modeling and Control, Wiley & Sons, (2005).
4. J. J. Craig, "Introduction to Robotics: Mechanics and Control", 3rd edition, Addison-Wesley (2003).
5. S. K. Saha, Introduction to Robotics 2e, TATA McGraw Hills Education (2014).
6. Thomas Kailath, "Linear Systems", Prentice Hall (1980).
7. Alok Sinha, "Linear Systems: Optimal and Robust Control", Taylor & Francis (2007).

Course Outcome :

After learning the course, the students will able to:

Sr. No.	CO statement	Marks % weightage
CO-1	Summarize the fundamentals of control systems.	20
CO-2	Illustrate linear control system and it's application in robot control.	30
CO-3	Make use of non-linear control system for robot control.	30
CO-4	Analyze robot motion control.	20

List of Open-Source Software/learning websites:

1. https://onlinecourses.nptel.ac.in/noc22_me05
2. https://onlinecourses.nptel.ac.in/noc20_ee90