Reg. No. : | | | | | | | | | | | | |

Question Paper Code: UB706

B.E./B.Tech. DEGREE EXAMINATION, NOV 2024

Professional Elective

Biomedical Engineering

21BMV706 ROBOTICS IN MEDICINE

(Common to Biotechnology)

(Regulations 2021)

Duration: Three hours | Maximum: 100 Marks

Answer All Questions

PART A - (10x 2 = 20 Marks)

1.	What are the different types of joints used in robotic systems?	CO1-U
2.	List the different types of movements associated with DOF in robotic systems	CO1-U
3.	What are the basic dynamic equations used in robotics for multi-DOF systems?	CO1-U
4.	Write the significance of kinetic and potential energy in Lagrangian analysis for robot dynamics.	CO1-U
5.	What ways can feedback be adjusted to reduce the steady-state error in a control system?	CO1-U
6.	In what situations would you increase the Derivative term to minimize overshoot in a control system?	CO1-U
7.	How would you apply the Hough transform to detect circles in a noisy image?	CO1-U
8.	What are the basic images processing techniques used for object recognition?	CO1-U
9.	How would you apply image segmentation to separate objects from the background in a robotic vision system?	CO1-U
10.	Describe the application of fuzzy control in biomedical engineering.	CO1-U

PART – B (5 x 16= 80 Marks)

11.	a	Analyze how limitations in workspace can affect the effectiveness of articulated robots during intricate surgeries.	CO1-U	(16)

Or

	b	Consider a medical robot for a specific application, describing its position analysis and how we can able to enhance surgical precision.	CO1-U	(16)
12.	a	What are the challenges in solving forward and inverse kinematics for spatial parallel robots in medical applications, and how do these challenges impact surgical precision and control?	CO1-U	(16)
		Or		
	b	What are the primary strategies medical robots employ to manage large-scale motions while ensuring stability and accuracy in differential motions, particularly in procedures involving soft tissue manipulation?	CO1-U	(16)
13.	a	Analyze the performance of PID controllers in controlling robotic arms used for minimally invasive surgery, focusing on case studies in robotic-assisted neurosurgery.	CO2-U	(16)
		Or		
	b	Evaluate the impact of MIMO technology on surgical outcomes by examining specific case studies in complex procedures like laparoscopic surgery or orthopedic applications.	CO2-U	(16)
14.		What are the challenges associated with integrating position, velocity, and force sensors into medical robots, and how do these challenges affect the performance of robotic surgical systems?	CO1-U	(16)
		Or		
		In what ways can the manipulation of lighting conditions and the use of color images aid in the differentiation of anatomical structures during robotic-assisted surgeries, and how does this improve surgical outcomes?	CO1-U	(16)
15.	a	(i) Analyze specific case studies where fuzzy control has improved rehabilitation effectiveness and patient satisfaction.	CO1-U	(8)
		(ii) How can fuzzy control systems be designed to handle the variability in patient responses during rehabilitation, and what are the implications for therapy effectiveness?	CO1-U	(8)
		Or		

b	(i) Design a hypothetical medical robotic system that incorporates both touch and range finding sensors. What specific features would enhance its accuracy and safety during surgical procedures?	CO1-U	(8)
	(ii) What are the challenges and limitations associated with the implementation of robotic systems in clinical diagnostics, and how can these challenges impact patient care?	CO1-U	(8)