Name: **Enrolment No:**	

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2023

Course: M.Tech Automation and Robotics **Semester: II**
Program: Industrial, Service and Medical Robots **Time: 03 hrs.**
Course Code: ECEG7030 **Max. Marks: 100**

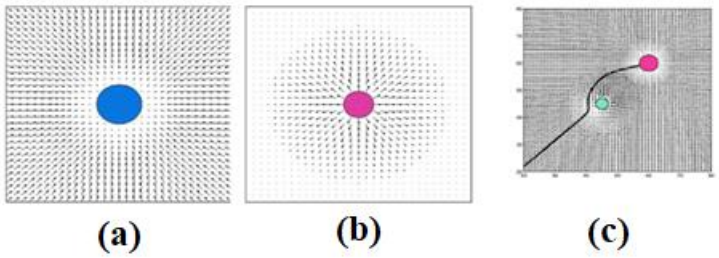
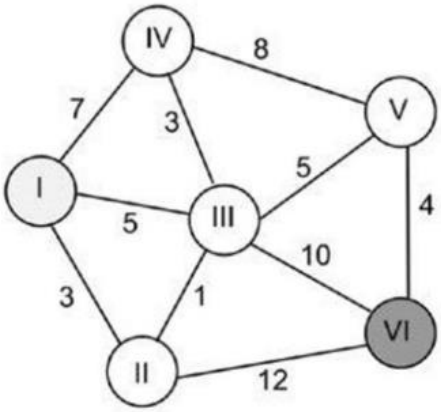
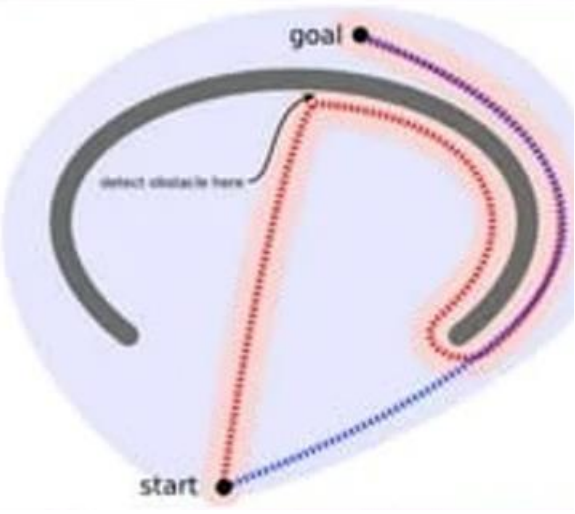
Instructions: All questions are compulsory. Scientific calculator is allowed.

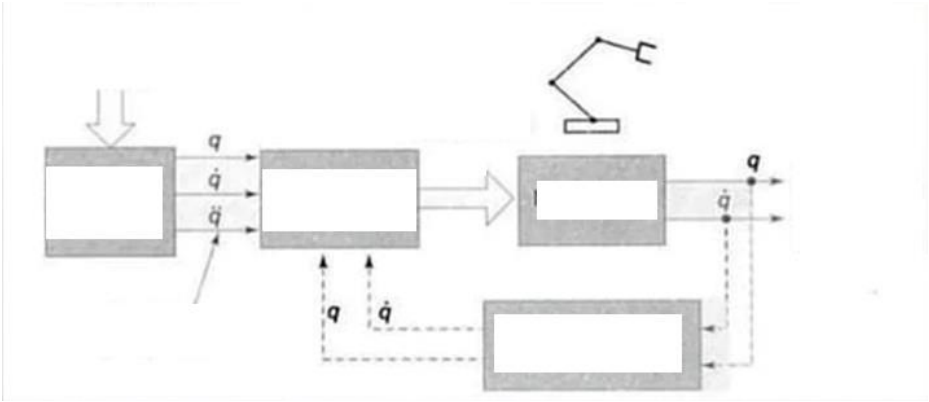
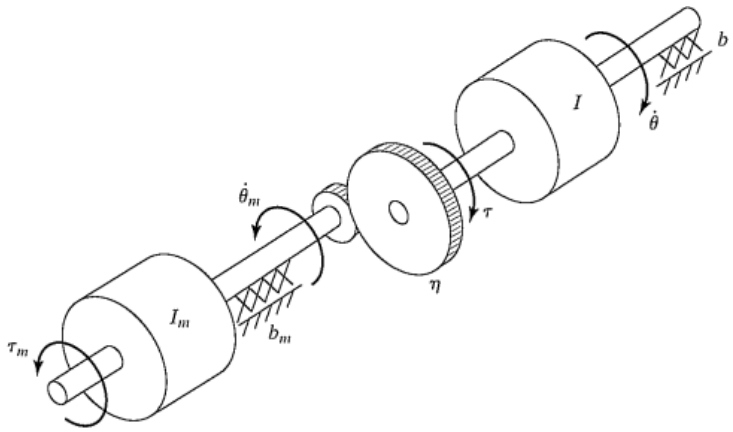
SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	Categorize the service and field robotics?	**4**	**CO1**
Q 2	Why critically damped system is preferred over other systems in terms of performance of controller?	**4**	**CO1**
Q 3	What are the challenges in Localization?	**4**	**CO2**
Q 4	How SLAM can play vital role while working with field robotics?	**4**	**CO2**
Q 5	List the assistive robot used in medical field?	**4**	**CO3**

SECTION B
(4Qx10M= 40 Marks)

Q6	Discuss the characteristics and capabilities of service robots?	**10**	**CO1**
Q 7	Design a control diagram and explain the architecture for robot with desired input trajectory being Cartesian circular trajectory?	**10**	**CO1**
Q 8	Elaborate the functional difference between the working of Zeus and Da Vinci surgical robotic systems?	**10**	**CO3**
Q 9	Design a control diagram and explain the architecture for robot with desired input trajectory being Cartesian circular trajectory? **OR** Identify the type of potential field shown in Fig. 1 and derive the system equation for attractive and repulsive potential field?	**10**	**CO2**

	 Fig. 1 Potential field		
	SECTION-C **(2Qx20M=40 Marks)**		
Q 10	Design the shortest path between I and IV using Dijkstra's algorithm for Fig. 2?  Fig. 2 Minimum cost How A* algorithm will be used for reaching goal from starting position for the problem shown in Fig. 3?  Fig. 3: Objective for A* algorithm	**20**	**CO2**

Q 11	Using the reference of the given Fig. 4, design the controller for single joint. Further explain the controller for desired circular trajectory for two-link manipulator.  Fig. 4. Reference control loop. **OR** Design the torque balance system for reference Fig. 5. If the apparent link inertia, *I*, varies between 5 and 10 $Kg\text{-}m^2$, the rotor inertia is $I_m = 0.01$, and gear ratio = 20, what are the minimum and maximum of effective inertia?  Fig. 5 Single joint rotor system.	**20**	**CO3**