Name: **Enrolment No:**	

UPES

End Semester Examination, May 2025

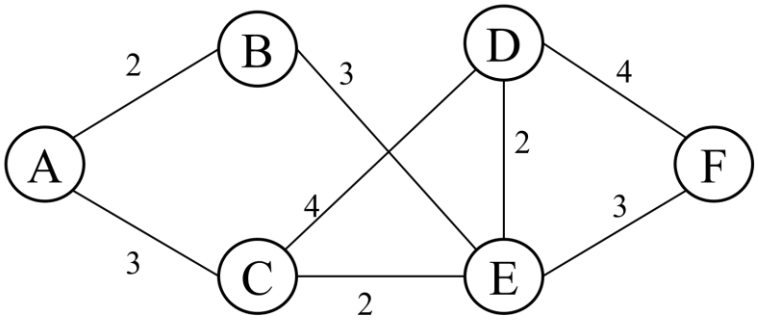
Course: Robot Motion Planning and Navigation **Semester: II**

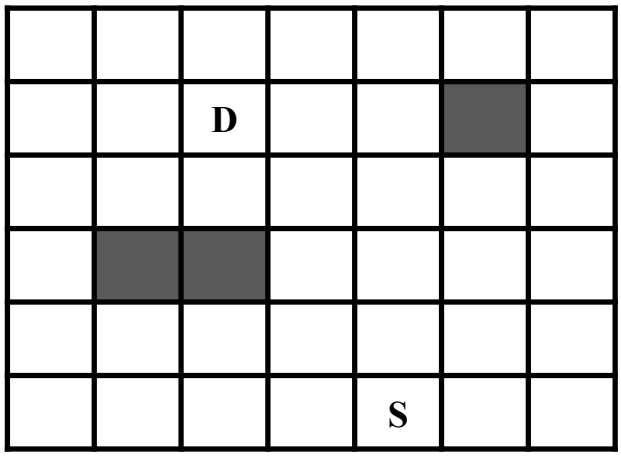
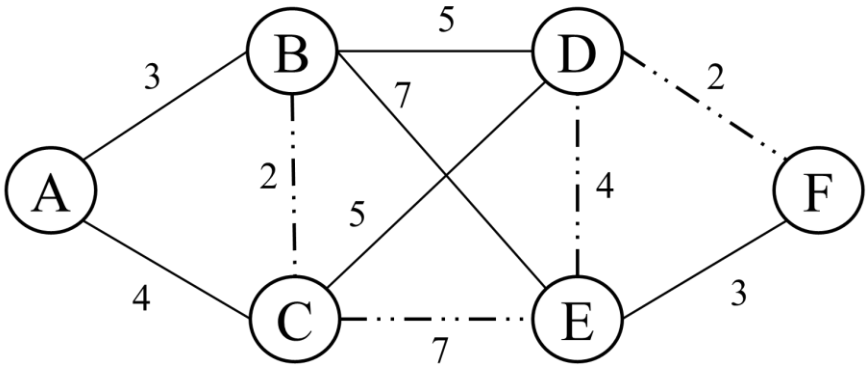
Program: M.Tech Robotics Engineering **Time : 03 hrs.**

Course Code: ECEG7040 **Max. Marks: 100**

Instructions: Read all questions carefully. State your assumptions

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	Enumerate the advantages of the Grassfire algorithm in determining the path from source to destination.	**4**	**CO1**
Q 2	Explain the role of a robust path in path planning and its importance in ensuring reliable navigation.	**4**	**CO2**
Q 3	Describe the role of path planning algorithms in the autonomous navigation of a robot.	**4**	**CO1**
Q 4	Identify common scenarios where directed and undirected weighted graphs are applied in path planning.	**4**	**CO2**
Q 5	Illustrate the advantages of linear quadratic regulator in trajectory tracking by an autonomous robot.	**4**	**CO1**
SECTION B **(4Qx10M= 40 Marks)**			
Q 6	Illustrate how the Dijkstra algorithm can be used to obtain the shortest distance path for the given graph network. 	**10**	**CO2**
Q 7	Discuss the drawbacks of using PID control for trajectory tracking in robotics. Additionally, highlight situations where PID controllers remain commonly used and perform effectively.	**10**	**CO3**
Q 8	Explain feedback control design based on a robot's kinematic model, with a suitable example.	**10**	**CO3**
Q 9	Describe the role of user comfort as an objective in path planning. Explain why comfort is important and how it can be incorporated into the cost function of planning algorithms.	**10**	**CO4**

	Or Explain the significance of considering kinematics constraints of autonomous robots in path planning. Discuss why they matter and how they can be incorporated in planning algorithms.		
	SECTION-C **(2Qx20M=40 Marks)**		
Q 10	In the given arena, black cells represent obstacles, white cells denote free space, (S) marks the Start, and (D) the Destination: (a) Select a suitable robust path planning algorithm with assumptions. (b) Briefly explain the algorithm procedure. (c) Compute the path from start to goal. (d) llustrate the resulting path and justify its robustness.  Or Obtain the minimum time path from node A to node F using Dijkstra's algorithm for the given graph network. The graph represents distances as costs between node pairs. The autonomous system moves at an average speed of 2 units/sec on solid roads (–) and 1 unit/sec on dashed roads (– ..–).  	**4+4+8+4** **20**	**CO4**
Q 11	Evaluate the shortest path using the RRT * algorithm. Outline the step-by-step process of path planning and specify any assumptions made for path evaluation. The grid map includes black cells as obstacles, white	**12+4+4**	**CO3**

	cells as free space, with (S) denoting the start cell and (D) the destination cell.