Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent institution of MAHE, Manipal)

VII SEMESTER B.TECH. (MECHATRONICS ENGINEERING)

END SEMESTER EXAMINATIONS, NOV 2018

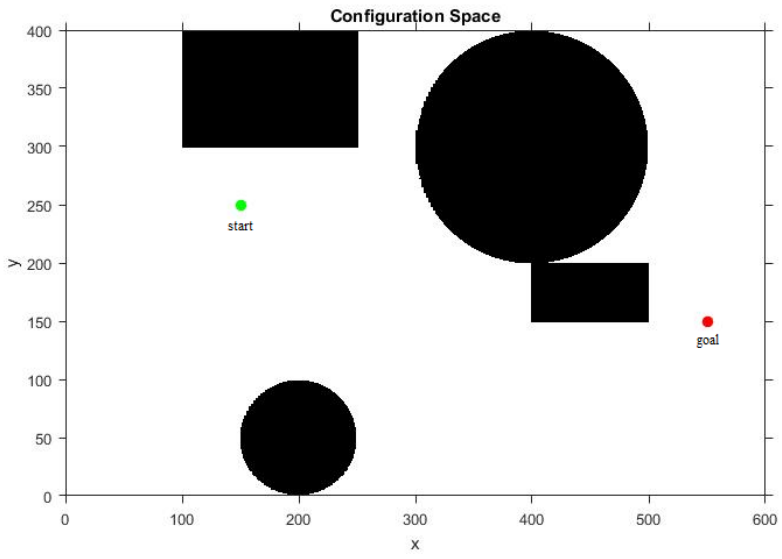
SUBJECT: ROBOT PATH PLANNING [MTE 4008]

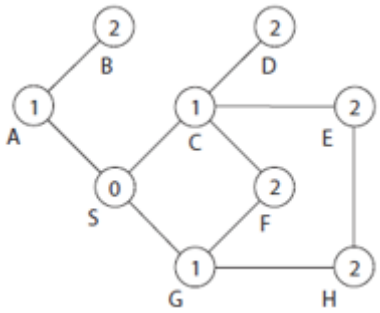
(01/12/2018)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Data not provided may be suitably assumed with justification.

1A.	Interpret the degrees of freedom of a plane parked on a runway as well as flying in the sky.	**5**
1B.	Demonstrate $f(x) = 5x + 2$ is surjective for all $x \in I$ (an integer). What about for all x $\in Z$.	**3**
1C.	Analyze the use of matrix representation in position and orientations of a rigid body configurations.	**2**
2A.	Given the following workspace with obstacles as shown in Fig. 2A, map the path between the start and the goal using the gradient descent algorithm. Also, discuss the merits and demerits.  Fig. 2A	**3**

2B.	For a Breadth First Search (BFS), identify the actions for the graph given in Fig. 2B.  Fig. 2B	**2**
2C.	Categorize the time complexity analysis of an algorithm with neat diagrams.	**5**
3A.	Contemplate on the pre-image theorem of Generalized Voronoi Graph (GVG).	**2**
3B.	Discuss the time-scaling algorithm in trajectory planning.	**5**
3C.	Discuss the non-holonomic constraints in motion planning.	**3**
4A.	It is desired to have the first joint of a 6-axis robot go from initial angle of 30^0 to a final angle of 75^0 in 5 seconds. Using fifth-order polynomial, calculate the joint angle at 1, 2, 3, and 4 seconds, assume the initial acceleration and final deceleration will be $5^0/s^2$.	**5**
4B.	Design the algorithm for RTAA* with a minimum of two convex obstacles.	**3**
4C.	Explain Optimal motion planning.	**2**
5A.	Contemplate on the pseudocode of RRTs.	**5**
5B.	Analyze the Morse cell decomposition.	**5**