Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

VII SEMESTER B.TECH. (MECHATRONICS ENGINEERING)

END SEMESTER EXAMINATIONS, 2019

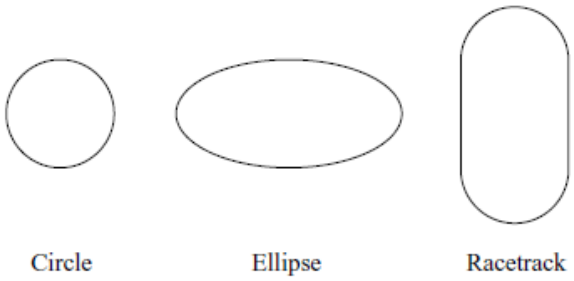
SUBJECT: ROBOT PATH PLANNING [MTE 4008]

(/11/2019, 2:00 PM-5:00 PM)

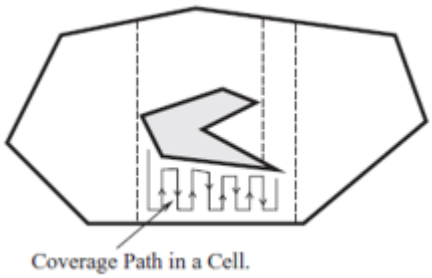
Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

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

1A.	Compare any three robotic systems with its topology and its sample representation.	**3**	**CO1**
1B.	Explain regarding tracing the boundary of a polygon robot translating & rotating in 2-D workspace.	**2**	**CO1**
1C.	Construct the equations of one-dimensional surfaces given in Fig. 1C, also, state the correlation of homeomorphism and diffeomorphism among them.  Fig. 1C: One-dimensional surfaces.	**5**	**CO1**
2A.	State the Minkowski sum and differences of two complex polygon.	**3**	**CO1**
2B.	Construct a graph for Fig. 2B in terms of A* search algorithm and write its pseudocode.	**4**	**CO2**

	<pre>{ 1, 0, 1, 1, 1, 1, 0, 1, 1, 1 },
	{ 1, 1, 1, 0, 1, 1, 1, 0, 1, 1 },
	{ 1, 1, 1, 0, 1, 1, 0, 1, 0, 1 },
	{ 0, 0, 1, 0, 1, 0, 0, 0, 0, 1 },
	{ 1, 1, 1, 0, 1, 1, 1, 0, 1, 0 },
	{ 1, 0, 1, 1, 1, 1, 0, 1, 0, 0 },
	{ 1, 0, 0, 0, 0, 1, 0, 0, 0, 1 },
	{ 1, 0, 1, 1, 1, 1, 0, 1, 1, 1 },
	{ 1, 1, 1, 0, 0, 0, 1, 0, 0, 1 }</pre> Fig. 2B: Input grid for the A* search algorithm.		

2C.	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 a third-order polynomial, calculate the joint angle at 1, 2, 3, and 4 seconds.	**3**	**CO4**
3A.	Write the different types of roadmaps along with the necessary sketches.	**3**	**CO3**
3B.	Analyze and write the properties of GVD roadmap by stating its critical points.	**5**	**CO3**
3C.	Write the deformation retract definition with a neat sketch.	**2**	**CO3**
4A.	Design the Canny's roadmap algorithm giving its critical values and critical points.	**5**	**CO3**
4B.	Analyze and design the Boustrophedon Decomposition algorithm for Fig. 4B given below.  Fig. 4B: Boustrophedon Decomposition of a trapezoidal cell. .	**5**	**CO3**
5A.	Write on the pseudocode of RRT* with an example.	**5**	**CO3**
5B.	Explain the steps of zero-points inertia in a decoupled trajectory planning with proper diagram.	**5**	**CO4**