

University of Mumbai
Examination 2020 under cluster __ (Lead College: _____)

Program: **Computer Engineering**

Curriculum Scheme: Rev 2016

Examination: BE Semester VII

Course Code: **CSDLO7033** and Course Name: **Robotics**

Time: 2 hour

Max. Marks: 80

Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
1.	Which of the following joints have one degree of freedom
Option A:	Cylindrical
Option B:	Ball and Socket
Option C:	Prismatic
Option D:	Twist
2.	Teach pendant is used for
Option A:	manual teaching
Option B:	lead-through teaching
Option C:	off-line teaching
Option D:	robot programming
3.	Identify the applications for which a point to point robot is suitable *
Option A:	Spot welding
Option B:	Spray painting
Option C:	Loading and unloading
Option D:	Arc welding
4.	Rotation of a 3-D object can be represented in 3-D space using
Option A:	4×4 matrix
Option B:	3×3 matrix
Option C:	5×5 matrix
Option D:	6×6 matrix
5.	Inverse Kinematics of a manipulator aims to determine
Option A:	position and orientation of the end- effector with respect to its base coordinate system
Option B:	joint angles for the known position and orientation of the end-effector with respect to its base coordinate system
Option C:	joint forces/torques of the manipulator
Option D:	a collision-free path for it
6.	Forward Kinematics of a manipulator aims to determine
Option A:	position and orientation of the end- effector with respect to its base coordinate system
Option B:	joint angles for the known position and orientation of the end-effector with respect to its base coordinate system

Option C:	joint forces/torques of the manipulator																																								
Option D:	a collision-free path for it																																								
7.	The position of end-effector of a robot with respect to its base coordinate system can be represented in																																								
Option A:	Roll, Pitch and Yaw angles																																								
Option B:	Euler angles																																								
Option C:	the form of three vectors in cartesian coordinate system																																								
Option D:	Cylindrical coordinate system																																								
8.	The measure of spatial resolution with which the tool tip can be placed within the work envelope of a robot is termed as																																								
Option A:	repeatability																																								
Option B:	accuracy																																								
Option C:	precision																																								
Option D:	absolute error																																								
9.	Identify the applications for which a continuous motion robot is suitable																																								
Option A:	Spot welding																																								
Option B:	Spray painting																																								
Option C:	Loading and unloading																																								
Option D:	Arc welding																																								
10.	In screw transformation, what is the screw pitch for pure translation																																								
Option A:	0																																								
Option B:	infinity																																								
Option C:	+1																																								
Option D:	-1																																								
11.	A 5x8 binary image is as shown below: Calculate the number of bytes required to store the Run Length Encode																																								
	<table border="1"> <tr><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td></tr> <tr><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td></tr> <tr><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td></tr> <tr><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td></tr> <tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr> </table>	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
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Option D:	8																																								
12.	A 3x3 binary image is as shown below: <table border="1"> <tr><td>1</td><td>0</td><td>0</td></tr> <tr><td>0</td><td>1</td><td>0</td></tr> <tr><td>0</td><td>0</td><td>1</td></tr> </table> The centroid of the image is located at	1	0	0	0	1	0	0	0	1																															
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Option A:	(1,1)																																								
Option B:	(1,2)																																								

Option C:	(2,1)																		
Option D:	(2,2)																		
13.	<p>A 3x3 binary image is as shown below:</p> <p>□x y□</p> <table border="1"> <tr><td>1</td><td>0</td><td>0</td></tr> <tr><td>0</td><td>1</td><td>0</td></tr> <tr><td>0</td><td>0</td><td>1</td></tr> </table> <p>It is scaled in x direction be 2. What will be resultant scaled image</p>	1	0	0	0	1	0	0	0	1									
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15.	<p>Calculate the centroid of the image</p> <table border="1"> <tr><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td></tr> <tr><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td></tr> <tr><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td></tr> </table>	1	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	1							
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Option A:	(2,2)																									
Option B:	(4,4)																									
Option C:	(4,2)																									
Option D:	(2,4)																									
16.	<p>A grey scale image of size (4x4) is as shown below</p> <table border="1"> <tr><td>2</td><td>1</td><td>0</td><td>0</td></tr> <tr><td>0</td><td>0</td><td>5</td><td>0</td></tr> <tr><td>0</td><td>4</td><td>0</td><td>6</td></tr> <tr><td>1</td><td>0</td><td>5</td><td>0</td></tr> </table> <p>Try to locate a diamond whose size is (3x3) by template matching techniques.</p> <table border="1"> <tr><td>0</td><td>4</td><td>0</td></tr> <tr><td>3</td><td>0</td><td>5</td></tr> <tr><td>0</td><td>4</td><td>0</td></tr> </table> <p>Using performance index method find the position at which the best match occurs</p>	2	1	0	0	0	0	5	0	0	4	0	6	1	0	5	0	0	4	0	3	0	5	0	4	0
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Option A:	0.8167																									
Option B:	0																									
Option C:	0.9994																									
Option D:	0.992																									
18.	<p>A grey scale image of size (5x5) is as shown below</p> <table border="1" style="margin-left: 20px;"> <tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr> <tr><td>0</td><td>1</td><td>1</td><td>1</td><td>0</td></tr> <tr><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td></tr> <tr><td>0</td><td>1</td><td>1</td><td>1</td><td>0</td></tr> <tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr> </table> <p>Find the chain code for the boundary</p>	0	0	0	0	0	0	1	1	1	0	1	0	0	0	1	0	1	1	1	0	0	0	0	0	0
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Option A:	$a=[1,3,4,4,5,7,0,0]^T$																									
Option B:	$a=[3,4,4,5,7,0,0,1]^T$																									
Option C:	$a=[0,3,4,4,5,7,0,1]^T$																									
Option D:	$a=[1,3,4,4,5,7,0,0]^T$																									
19.	The trajectory between points w^0 and w^1 is to be approximated using linear interpolation $w(t) = at + b$ over the interval $[0 T]$. Find the expression for a and b																									
Option A:	$a = \frac{w^0-w^1}{T}, b = w^1$																									
Option B:	$a = \frac{w^0-w^1}{T}, b = w^0$																									
Option C:	$a = \frac{w^1-w^0}{T}, b = w^0$																									
Option D:	$a = \frac{w^1-w^0}{T}, b = w^1$																									
20.	The trajectory between points w^0 and w^1 is to be approximated using linear interpolation $w(t) = at + b$ over the interval $[0 T]$. What can we say about the velocity $v(t)$ and acceleration $a(t)$																									
Option A:	$v(t)= a, a(t)=0$																									
Option B:	$v(t)= 0, a(t)=0$																									
Option C:	$v(t)=a, a(t)=\text{constant}$																									
Option D:	$v(t)=a, a(t)= at$																									

Q2	Write a short note on (any four Questions out of six 05 marks each)
A	Sensors and actuators
B	Fuzzification and defuzzification
C	Tangent Bug Algorithm
D	Reactive Paradigm
E	Robotic Manipulator SCARA
F	Applications of Robots

Q3	Solve any Two Questions out of Three 10 marks each
A	A point $p(7,3,1)^T$ is attached to the frame F_{noa} and is subjected to following transformations. Find the coordinate of the point relative to the reference

	frame at the conclusion of transformation i. Rotation of 90 deg about the z-axes ii. Followed by rotation of 90 deg about y axis iii. Followed by translation of [4.-3,7]
B	Explain the steps to implement an expert system in detail
C	Explain different Image Representation Techniques in detail