

2015

Time : 3 hours

Full Marks : 80

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Answer from both the Groups as directed.

Group – A

(Objective Type Questions)

1. Choose the correct answer of the following :
 $2 \times 10 = 20$
 - (a) An android takes the form of :
 - (i) An Insect
 - (ii) A Human Body
 - (iii) A simple robot arm
 - (iv) Binocular vision

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(Turn over)

- (b) According to Asimov's three laws, under what circumstances is it all right for a robot to injure a human being ?
- (i) Never
 - (ii) When the human being specifically requests it
 - (iii) In case of an accident
 - (iv) In case the robot controller is infected with a computer virus
- (c) Second-generation robots first were used around the year :
- (i) 1950
 - (ii) 1960
 - (iii) 1970
 - (iv) 1980
- (d) An automotive robot might best keep itself travelling down a specific lane of traffic by using :
- (i) Binaural Hearing

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(2)

Contd.

- (ii) Epipolar navigation
 - (iii) Edge detection
 - (iv) A second generation end effector
- (e) A rule-based system is also known as :
- (i) Artificial Intelligence
 - (ii) An expert system
 - (iii) An analytical engine
 - (iv) An automated guided vehicle
- (f) A manipulator is also known as a :
- (i) A track drive
 - (ii) Robot arm
 - (iii) Vision system
 - (iv) Robot controller
- (g) Spherical coordinates can uniquely define the position of a point in up to :
- (i) One dimension
 - (ii) Two dimension
 - (iii) Three dimension
 - (iv) Four dimension

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(Turn over)

Group – B

(Long-answer Type Questions)

Answer any four questions of the following :

15×4 = 60

2. (a) What is the difference between Path and Trajectory and what is Trajectory Planning ?
(b) Define Pixel function, shrink operator and swell operator.
3. (a) What are the advantages and disadvantages of PLC system ?
(b) Compute the joining variable vector $q = (q^1, q^2, q^3, q^4)^T$ for the following where $w = (203.4, 662.7, 557.0, 0, 0, -1.649)^T$.
4. (a) Consider the stanford Manipulator, derive the complete set of forward kinematic equation by establishing appropriate D-H coordinate frames, constructing a table of link parameters.
(b) With neat sketch write basic four steps for transferring frame K – 1 to frame K.

- (h) A color vision system can use three gray-scale cameras, equipped with filters that allow which three colors of light to pass ?
- (i) Blue, Red and Yellow
 - (ii) Blue, Red and Green
 - (iii) Cyan , Magenta and Yellow
 - (iv) Orange, Green and Violet
- (i) Proximity sensing is most closely akin to :
- (i) Direction measurement
 - (ii) Epipolar navigation
 - (iii) Distance measurement
 - (iv) Machine vision
- (j) A robot that has its own computer and can work independently of other robots or computers is called an :
- (i) Android
 - (ii) Insect robot
 - (iii) Automated guided vehicle
 - (iv) Automorous robot

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(4)

Contd.

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(5)

(Turn over)

5. (a) What are the important edge detection methods for polygonal objects ? Explain one of the edge detection technique ?
- (b) What are area descriptors ? What are its advantages over line descriptors ? Explain the different moments to characterizing shape.
6. (a) Explain the equivalent ladder diagram to demonstrate De Morgan's theorem.
- (b) Draw a ladder diagram for two motor system having the following conditions :
- The start switch star motor 1 ; and 15 second later motor 2 starts ; the stop switch stops motor 1 and 20 seconds later motor 2 stops
7. Write short notes on any three of the following :
- (a) Classification of robots
- (b) Properties of Inverse kinematics solutions
- (c) Bounded Deviation Algorithm for straight line motion planning

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(6)

Contd.

- (d) Template matching technique for apart recognition
8. (a) Discuss briefly about touch sensors used in robotics.
- (b) Explain the principles of servomotor.
9. Write short notes on any three of the following :
- (a) PID Controller
- (b) Proximity sensor
- (c) PWM Amplifiers
- (d) Mobile Robot



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(7)

BCA(III) / 21B / 15