

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
SIXTH SEMESTER B.TECH DEGREE EXAMINATION, APRIL 2018

Course Code: EC368
Course Name: ROBOTICS (EC)

Max. Marks: 100

Duration: 3 Hours

PART A

Answer any two full questions, each carries 15 marks.

Marks

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| 1 | a) | Justify the statement: <i>Actuators are the muscles of robots.</i> | (5) |
| | b) | Robots find applications not only in the industry. Explain <i>three</i> non-industrial applications of robots. | (6) |
| | c) | What are the advantages and disadvantages of electric drive systems? | (4) |
| 2 | a) | Which are the sensors used in robots for sensing position and force? Mention an application each where these sensors are used. | (10) |
| | b) | How robots are classified based on drive technologies? | (5) |
| 3 | a) | Provide the typical features of robotic actuator and drive systems. | (5) |
| | b) | Illustrate the difference between linear and rotary actuation mechanisms using hydraulic drive. | (5) |
| | c) | Explain in detail the speed control of motors using PWM and direction control using H- Bridge | (5) |

PART B

Answer any two full questions, each carries 15 marks.

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| 4 | a) | Explain about different image processing techniques. | (6) |
| | b) | Describe any three applications of image processing in robotics | (6) |
| | c) | Name the image processing steps required for find the shape of an object in the work environment of a robot. | (3) |
| 5 | a) | What do you mean by homogeneous transformation matrix? | (5) |
| | b) | A point $p(7,3,1)^T$ is attached to a frame F_{mob} and is subjected to the following transformations. Find the coordinates of the point relative to the reference frame at the conclusion of transformations if following rotations and translations are happening with respect fixed reference frame. <ul style="list-style-type: none">• Rotation of 90° about the Z axis• Followed by a rotation of 90° about the y-axis• Followed by a translation of 4 units along x axis | (10) |
| 6 | a) | Explain about joint angle, joint distance, link length and link twist with help of sketches? How link parameter table is obtained if you know these parameters? | (10) |
| | b) | If you know the end effector position and orientation how will you find the joint angles? Explain with help of an example. | (5) |

PART C

Answer any two full questions, each carries 20 marks.

- 7 a) What is the relevance of the Jacobian operator in velocity kinematics? (5)
- b) What do you mean by manipulator Jacobian. (5)
- c) List five recent developments in the field of robotics. (10)
- 8 a) Explain in detail about different control schemes of robots. (15)
- b) Explain about Lagrangian mechanics? How will you derive dynamic model of robot? (5)
- 9 a) Which are the commonly used robot programming methods? (5)
- b) Write examples for Motion, End-effector and Sensor commands in VAL programming language. (5)
- c) What are mobile robots and what are the different classifications of mobile robots? (10)
