Enrollment No......................................

Faculty of Engineering

End Sem (Odd) Examination Dec-2019

ME3EL03 Robotics Engineering

Programme: B.Tech.   Branch/Specialisation: ME

Duration: 3 Hrs.   **Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d.

Q.1   i.   What is the name for space inside which a robot unit operates?   **1**
            (a) Environment   (b) Spatial base
            (c) Work envelope   (d) Exclusion zone

      ii.   Which of the following terms is not one of the five basic parts of   **1**
            robot?
            (a) Peripheral tools   (b) End effectors
            (c) Controllers   (d) Drive

      iii. The columns of rotation matrix are unit vectors, orthogonal to one   **1**
            another.
            I. ${}^{A}X_B * {}^{A}X_B = {}^{A}Y_B * {}^{A}Y_B = {}^{A}Z_B * {}^{A}Z_B = 1$
            II. ${}^{A}X_B * {}^{A}Y_B = {}^{A}Y_B * {}^{A}Z_B = {}^{A}Z_B * {}^{A}X_B = 0$
            Select the correct option
            (a) Only I   (b) Only II
            (c) Both I and II   (d) None of these

      iv.   Reference to D-H parameter   **1**
            (a) d_i is the distance from X_{i-1} and X_i measured along Z_i.
            (b) d_i is the distance from Y_{i-1} and Y_i measured along Z_i.
            (c) d_i is the distance from Z_{i-1} and Z_i measured along X_i.
            (c) d_i is the distance from Z_{i-1} and Z_i measured along Y_i.

      v.   Newton-Euler equations are known as   **1**
            (a) Energy based approach   (b) Vectorial approach
            (c) Both (a) and (b)   (d) None of these

      vi.   Mass moment of inertia of an object is a property of   **1**
            (a) Mass   (b) Shape
            (c) Both (a) and (b)   (d) None of these

                                                                    P.T.O.

vii. What is the name for information sent from robot sensors to robot controllers? **1**
(a) Temperature   (b) Pressure
(c) Feedback   (d) Signal

viii. Which of the following is correct for proximity sensors? **1**
(a) Inductive type   (b) Capacitive type
(c) Ultrasonic wave type   (d) All of these

ix. Online programming has the following advantage/s over offline programming **1**
(a) Easily accessible
(b) In programming
(c) In concordance with the actual position of equipment
(d) All of these

x. Offline programming has the following disadvantage over online programming **1**
(a) Poorly documented
(b) Difficult to incorporate sensor data
(c) Need of expert users
(d) None of these

Q.2   i. Write the laws of robotic. **3**
     ii. Give the classification of robot with brief explanation and neat sketch. **7**
OR   iii. Explain the robot anatomy with neat sketch. **7**

Q.3   i. Explain the coordinate transformation of a frame subjected to translation and rotation both. **4**
     ii. Explain the D-H Representation. **6**
OR   iii. Explain the Euler angles with neat sketch and obtain rotation matrix of any Euler angle. **6**

Q.4   i. Explain the generalised coordinate. **3**
     ii. Give the detailed explanation of the inertia tensor matrix. **7**
OR   iii. Explain the Euler-Lagrange formulation in detail. **7**

Q.5   Attempt any two:
   i. Explain the inductive proximity sensor with neat sketch **5**
   ii. Give the brief description of Parallel, angular and toggle gripper with neat diagram. **5**
   iii. Explain any five parameters for the selection of gripper. **5**

Q.6   Attempt any two:
   i. Write the advantages and disadvantages of online and off line programming **5**
   ii. Explain lead through programming **5**
   iii. Write the name of robotic programming languages and explain any of two. **5**

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Q.1   i.   What is the name for space inside which a robot unit operates?   **1**
          (c) Work envelope

     ii.   Which of the following terms is not one of the five basic parts of   **1**
robot?
          (a) Peripheral tools

     iii.   The columns of rotation matrix are unit vectors, orthogonal to one   **1**
another.
          (c) Both I and II

     iv.   Reference to D-H parameter   **1**
          (c) d_i is the distance from Z_{i-1} and Z_i measured along X_i.

     v.   Newton-Euler equations are known as   **1**
          (b) Vectorial approach

     vi.   Mass moment of inertia of an object is a property of   **1**
          (c) Both (a) and (b)

     vii.   What is the name for information sent from robot sensors to robot   **1**
controllers?
          (c) Feedback

     viii.   Which of the following is correct for proximity sensors?   **1**
          (d) All of these

     ix.   Online programming has the following advantage/s over offline   **1**
programming
          (d) All of these

     x.   Offline programming has the following disadvantage over online   **1**
programming
          (c) Need of expert users

Q.2   i.   Laws of robotic   **3**
          Three statement 1 mark for each   (1 mark * 3)

     ii.   Classification of robot   **7**
          Five classification 1 mark for each (1 mark * 5)   5 marks
          Two diagram 1 mark for each (1 mark * 2)   2 marks

OR   iii.   Robot anatomy   **7**
          Sketch.   3 marks
          Explanation   4 marks

Q.3   i.   Translation and rotation Matrix   2 marks   **4**
          Transformation Matrix   2 marks

     ii.   All steps of D-H Representation   **6**
          Stepwise marking

OR   iii.   Euler angles and obtain rotation matrix of any Euler angle.   **6**
          Definition   1 mark
          Sketch   2 marks
          Rotation matrix   3 marks

Q.4   i.   Generalised coordinate   **3**
          Definition   1 mark
          Explanation   2 marks

     ii.   MOI definition   2 marks   **7**
          POI definition   2 marks
          Inertia tensor matrix   3 marks

OR   iii.   Kinetic energy   2 marks   **7**
          Potential energy   2 marks
          Euler-Lagrange formulation   3 marks

Q.5   Attempt any two:
     i.   Inductive proximity sensor   **5**
          Explanation   3 marks
          Sketch   2 marks

     ii.   Description of Parallel, angular and toggle gripper   **5**
          1 mark for each (1 mark * 3)   3 marks
          Diagrams   2 marks

     iii.   Any five parameters for the selection of gripper.   **5**
          1 mark for each parameters   (1 mark * 5)

Q.6   Attempt any two:
     i.   Advantages of online and off line programming   2.5 marks   **5**
          Disadvantages of online and off line programming   2.5 marks

     ii.   Lead through programming   **5**

     iii.   Name of robotic programming languages   3 marks   **5**
          Explanation any of two
          1 mark for each (1 mark *2)   2 marks

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