Reg. No. : ⬚⬚⬚⬚⬚⬚⬚⬚⬚⬚⬚⬚

Question Paper Code : 91058

B.E/B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022

Seventh/Ninth Semester

Aeronautical Engineering

OIE 751 — ROBOTICS

(Common to Aerospace Engineering/Agriculture Engineering/Automobile Engineering/Civil Engineering/Computer Science and Engineering/Computer and Communication Engineering/Electronics and Communication Engineering/ Electronics and Telecommunication Engineering/Industrial Engineering and Management/Manufacturing Engineering/Marine Engineering/ Material Science and Engineering/Mechanical Engineering/Mechanical Engineering (Sandwich)/Mechatronics Engineering/Production Engineering/ Robotics and Automation/Bio-Technology/Food Technology/ Information Technology/Pharmaceutical Technology)

(Regulations 2017)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1.   State the three laws of Robotics.

2.   Calculate the Degrees of Freedom of slider crank Mechanism.

3.   Distinguish between Hydraulic Drives and Mechanical Drives.

4.   How to select the Tools for your particular application?

5.   Define Pressure Sensors.

6.   List out various Lighting Techniques used in machine vision system.

7.   Write the Direct Kinematic equation of a 3 DOF TRR configuration robot.

8.   Write short notes on Trajectory generator.

9.   List out types of AGV vehicles.

10.   Mention any two Safety considerations for Robot Operations.

PART B — (5 × 13 = 65 marks)

11. (a) With neat sketches briefly discuss the functions of various parts of a Robot. (13)

Or

(b) Briefly explain the influence of the following parameters in the performance of robot.

   (i) Centre of gravity (4)

   (ii) Stability (4)

   (iii) Precision of the robot. (5)

12. (a) With neat sketches explain the working principle of
   (i) Cam actuated gripper
   (ii) Vacuum gripper. (6+7)

Or

(b) Explain the working principle, construction, applications, advantages and disadvantages of stepper motor.

13. (a) With sketches explain the working principle, construction and applications of the LVDT.

Or

(b) Explain the following with suitable applications

   (i) Touch Sensors

   (ii) Object Recognition (6+7)

14. (a) (i) In a TRR Configuration Robot the length of links of $I_1 = 38$ cm and $I_2 = 18$ cm. If I_1 and I_2 are in making an angle of 42° and 88° w.r.to XZ — Plane and the base is twisted at an angle of 28° w.r.to X- axis. Find the end position of the robot. (6)

   (ii) Find the joint angles θ_1 and θ_2 of the two DoF robot having link lengths of 28cm and 16cm. If the end effector position is $X = 24$, $Y = 14$. (7)

Or

(b) Explain the following

   (i) Trajectory Generator

   (ii) VAL Programming (7+6)

15. (a) Explain the various steps to be followed in the implementation of Robots in industries. (13)

Or

(b) With neat sketches explain the following.

   (i) Economic analysis of Robot

   (ii) RGV. (6+7)

PART C — (1 × 15 = 15 marks)

16. (a) Discuss a case study about applications of robots in surgery with suitable sketches. (15)

Or

(b) Derive the forward kinematics equation for 3 DOF TRR configuration robot using D-H Transformation matrix. (15)

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