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K 4406

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2009.

Seventh Semester

Mechatronics Engineering

MH 1401 — ROBOTICS AND MACHINE VISION SYSTEM

(Regulation 2004)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State the laws of robotics.

2. What is spatial resolution?

3. Write the homogeneous transformation matrix.

4. What are the advantages of trajectory planning in the joint-variable space?

5. What are the advantages of magnetic grippers?

6. What is Remote Centre Compliance device?

7. What are the functions involved in sensing and digitizing image data?

8. What is region growing?

9. What is template matching in object recognition?

10. What is statistical and structured principle in texture description?

PART B — (5 × 16 = 80 marks)

11. (a) (i) Explain the construction and working of stepper motor with a neat diagram. (8)

(ii) Explain the working principle of a vane type hydraulic pump. (8)

Or

(b) (i) With a neat diagram explain the basic structure of a robot. (10)

(ii) Explain the rack and pinion mechanism. (6)

12. (a) (i) For the vector $v = 10i + 15j + 20k$, perform a translation by a distance of 5 units in X direction, 2 units in Y direction, and 0 units in Z direction, followed by rotation by an angle of 90° about X-axis. Determine the end co-ordinates. (10)

(ii) Explain the joint-interpolated motion trajectories. (6)

Or

(b) (i) Explain any one planning of Cartesian path trajectories. (10)

(ii) With a neat diagram explain the model referenced adaptive control system. (6)

13. (a) (i) A simple pivot-type gripper device is used for holding the cardboard carton box as shown in the fig. 1. The gripping force is 50 N. Find out the actuating force. (8)

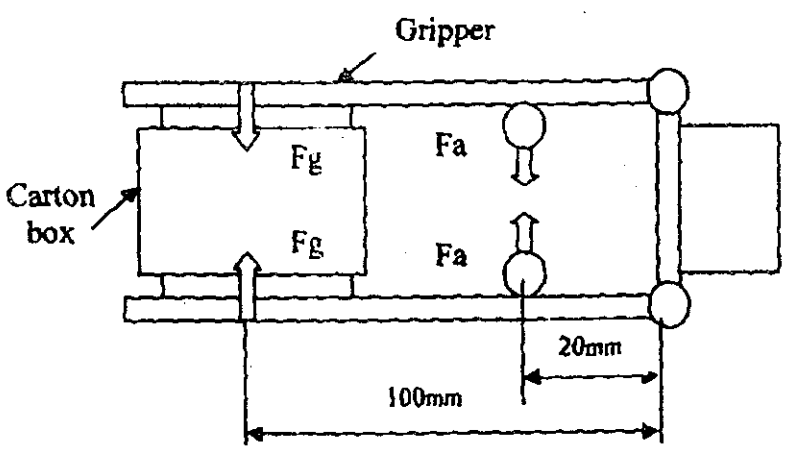

Fig. 1.

(ii) Discuss Remote Centre Compliance with its construction and working principle. (8)

Or

(b) (i) Explain the construction and working of a magnetic gripper. Discuss its advantage and disadvantage. (10)

(ii) A vacuum cup is used to lift a 0.5 kg plate. The cup dia. is 20 mm. Determine the gripping force. (6)

14. (a) (i) Discuss image data reduction. (8)

(ii) Explain the method of obtaining a binary image by thresholding. (8)

Or

(b) Explain region growing and region splitting in image processing. (16)

15. (a) (i) Explain the structural technique used in object recognition. (8)

(ii) Discuss the illumination techniques used in vision system. (8)

Or

(b) (i) Explain the technique used in motion tracking. (10)

(ii) Discuss the texture and texture analysis in vision system. (6)
