

College of Engineering, Pune (COEP)
(An Autonomous Institute of Government of Maharashtra)
END SEMESTER EXAMINATION

Subject: (PE 5252) Robot Dynamics & Analysis

Class: F.Y.M.Tech. Mechatronics

Date: 06/05/2012

Duration: 3.00 hrs

Sem: II

Year: 2011-12

Max. Marks 50

Instructions:

1. Attempt any Five questions.
2. Numbers to right shows marks assigned to questions.
3. Non-programmable calculator is allowed.
4. Assume suitable data if required.

Q.1 a) Explain the evolution of robot and its generations. Explain with the sketch the work envelope for Cartesian configuration Robot & Jointed arm configuration. (5)

b) Explain generalized D'Alembert principle. Deduce the equation for Lagrangian analysis for simple prismatic joint working against gravity. (5)

Q.2 a) With the sketch explain the external gripper and internal gripper. How do you select the gripper for various applications? (5)

b) Explain range and proximity sensors used in robotics. (5)

Q.3 a) Explain types of drives used in robot system. (5)

b) A simple robot has the link parameter table as follows: (5)

i	α_{i-1}	a_{i-1}	d_i	θ_i
1	0	0	0	45
2	90	2	0	0
3	0	0	3	90

Determine the origin of the gripper w.r.t. the base frame indicating all the intermediate steps.

Q.4 a) Explain the RS 232 C serial interfacing of robot for Hardware handshaking. (4)

b) Explain the Thresholding and region growing in Machine vision system. (3)

c) Explain programming methods for robot and also list the languages used for robot programming. (3)

- a) A 8x8 image has intensity value as given below: (4)
- i) Construct a histogram and obtain the threshold value.
 - ii) Convert the picture into black and white image after smoothening binary image.
- | | | | | | | | |
|----|----|----|----|----|----|----|----|
| 88 | 81 | 87 | 89 | 82 | 75 | 79 | 90 |
| 86 | 18 | 10 | 13 | 12 | 23 | 11 | 91 |
| 89 | 21 | 50 | 56 | 42 | 50 | 12 | 98 |
| 92 | 25 | 55 | 66 | 68 | 55 | 16 | 93 |
| 81 | 12 | 42 | 46 | 41 | 49 | 10 | 88 |
| 69 | 18 | 55 | 52 | 45 | 61 | 11 | 94 |
| 68 | 21 | 26 | 28 | 19 | 16 | 12 | 77 |
| 77 | 70 | 82 | 85 | 78 | 74 | 88 | 89 |

- b) Explain the methodology of obstacle avoidance using Lee's Algorithm. (3)
- c) How the guarding of robot is done during operation to identify hazard areas. Explain with suitable sketch (3)

- 6 a) The total investment on the robot is Rs. 10,00,000/- . There is 1 shift of operation of 2000hrs per year and 1 man is replaced. Assuming labor rate of Rs.100/per hr and robot running cost including maintenance and depreciation is Rs. 2,00,000/- and added value of increased output is Rs. 2,00,000/- . Determine the payback period for one shift and two shift operation. (5)

- b) A robot joint is required to reach 60 from 30 passing through 45 taking a total time of 3 seconds. Obtain a cubic polynomial fit using via point and sketch the trajectories. (5)

- 7 a) Explain the use of Robots in material handling. (3)
- b) Explain the stages of GRASP simulation and its applications. (3)
 - c) What is meant by Telecheirs? Explain the applications of telecheirs. (4)

COLLEGE OF ENGINEERING PUNE
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End-Semester Examination
(MX-518) Smart Materials, Sensors and Actuators

Programme: M.Tech (Mechatronics)

Year: 2011-12
Duration: 3 hrs
Date: 14/5/2012

Semester- II
Max. Marks: 50

Instructions:

1. All questions are compulsory
 2. Figures to right indicate full marks
 3. Make necessary assumptions and assume suitable data wherever required.
 4. Use of non-programmable calculator is allowed.
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- Q. 1 Is it feasible to implement MEMS as an accelerometers and airbag actuators in vehicles? Justify your answer with the following points:
- (a) i. features
 - ii. production technique
- 05
- Q. 1 Suggest an actuator for computer printers with its typical specifications.
- (b) Also discuss different types of the same actuator in detail.
- 05
- Q. 1 It is required to design smart material actuator for microrobotic system.
- (c) Discuss the detail design parameters with its typical characteristics.
- 05
- Q. 2 An electric generator is driven by a miniature gas turbine engine, is having lower efficiency as compared to macro-scale gas turbines. It is required to improve its efficiency at least by 5% with simple gas turbine. Suggest suitable design strategy with the specifications.
- 10
- Q. 3 Aerospace products such as rockets, satellites and aircrafts require monocoque shell like structures featuring a thin skin and the structural integrity is mission critical. Describe the following components for the above mentioned application in detail:
- i. sensor materials
 - ii. actuators
 - iii. data links

iv. control mechanism

If the same components is applicable to military aircraft design, suggest the required modifications in the above parameters 15

Q. 4 Discuss the following sensor material for its application ,with its required actuating system and control mechanism :

i. fiber bragg grating

ii. ER fluid

iii. Shape Memory Alloy

iv. Piezoelectric material

v. MR fluid

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