

OPERATIONS RESEARCH
(Mechanical Engineering)

Time: 3 hours

Max. Marks: 70

Answer any FIVE questions
All questions carry equal marks

- 1 Solve the following LP problem using big-M method:

$$\text{Minimize } Z = 2x_1 + 9x_2 + x_3$$

$$\text{Subject to } x_1 + 4x_2 + 2x_3 \geq 5;$$

$$3x_1 + x_2 + 2x_3 \geq 4;$$

$$x_1, x_2 \geq 0.$$

- 2 Find the optimal solution for the following transportation problem. The cell entries represent the unit transportation cost in rupees from each source to each destination.

		To					Supply
		3	4	6	8	9	20
From		2	10	1	5	8	30
		7	11	20	40	3	15
		2	1	9	14	16	13
	Demand	40	6	8	18	6	

- 3 A manufacturer, finds from his past records that the costs per year associated with a machine with a purchase price of Rs.50,000 are as given below:

Year	1	2	3	4	5	6	7	8
Maintenance (Rs.)	15000	16000	18000	21000	25000	29000	34000	40000
Scrap value in Rs.	35000	25000	17000	12000	10000	5000	4000	4000

Determine the optimum replacement policy.

- 4 Solve the following game by graphical method:

		Player B				
		1	2	3	4	5
Player A	1	-5	5	0	-1	8
	2	8	-4	-1	6	-5

Contd. in Page 2

- 5 An insurance company has 3 claims adjusters in their main office. Customers are found to arrive in Poisson manner at a rate of 5 per hour for settling claims against the company. The service time is found to have exponential distribution with a mean of 25 minutes. Claimants are processed on first come first served basis. Calculate:
- The average number of customers in the system.
 - The average time a customer spends in the system.
 - The average queue length.
 - The average waiting time for customers.
- 6 Find the optimum order quantity for a product for which the price breaks are as follows:
- | Quantity (units) | Unit cost (Rs.) |
|--------------------|-----------------|
| $0 < q < 650$ | 20 |
| $650 \leq q < 800$ | 18.50 |
| $800 \leq q$ | 17.50 |
- The monthly demand for the product is 300 units, the cost of carrying inventory is 2% of the unit price of the item and the cost of ordering is Rs.400.
- 7 Solve the following LP problem by dynamic programming:
- Maximize $f(x_1, x_2) = 4x_1 + 14x_2$;
Subject to $2x_1 + 7x_2 \leq 21$;
 $7x_1 + 2x_2 \leq 21$;
 $x_1 \geq 0, x_2 \geq 0$
- 8 (a) Define simulation. Explain various types of simulation.
(b) Explain briefly about simulation languages.

Code: 9A03702

B.Tech IV Year I Semester (R09) Supplementary Examinations, May 2013

AUTOMATION AND ROBOTICS

(Mechanical Engineering)

Time: 3 hours

Max Marks: 70

Answer any FIVE questions
All questions carry equal marks

1. List out and discuss about the basic elements of an automated system.
2. List out the various types of flow lines. Discuss flow line with and without buffer storage.
3. What are the considerations to be made in assembly line design?
4. Explain various configurations of robot with neat sketches.
5. Explain in detail about DH representation of robot with a suitable example.
6. Discuss the following methods of robot programming:
 - (i) Lead through teaching.
 - (ii) Walk through teaching.
 - (iii) Off-line programming.
7.
 - (a) Classify different sensors and actuators used in robotics.
 - (b) Discuss the working of following actuators:
 - (i) Pneumatic actuators.
 - (ii) Hydraulic actuators.
8.
 - (a) What are the desirable features of a robot for successful machine tool load/unload applications?
 - (b) Describe the applications of a robot in press working operation.

FINITE ELEMENT METHODS

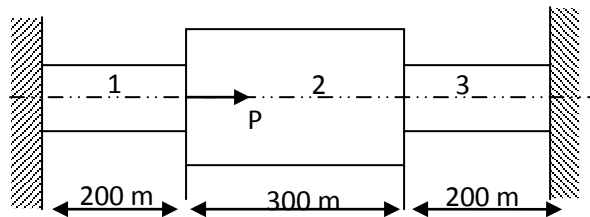
(Mechanical Engineering)

Time: 3 hours

Max Marks: 70

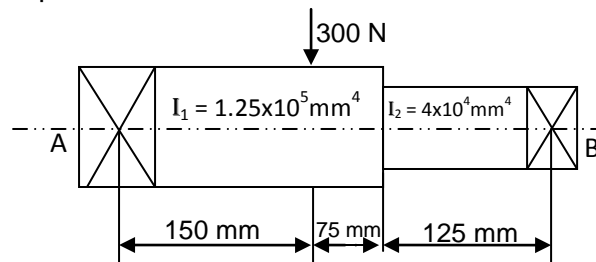
Answer any FIVE questions
All questions carry equal marks

- Explain the significance of node numbering and element numbering during the discretization Process.
 - Define the concept of potential energy.
 - List out any five advantages of using FEM.
- Explain the shape functions used in 1-D problems.
 - An axial load $P = 200 \times 10^3$ N is applied on a bar shown. Using the penalty approach for handling boundary conditions, determine nodal displacements, stress in each material and reaction forces



- $A_1 = 2400 \text{ mm}^2$
 $E_1 = 70 \times 10^9 \text{ N/m}^2$
- $A_2 = 600 \text{ mm}^2$
 $E_2 = 200 \times 10^9 \text{ N/m}^2$

- Find the deflection at the load and the slopes at the ends for the steel shaft shown in figure. Consider the shaft to be simply supported at bearings A and B. Solve by FEM technique. Take $E = 200$ Gpa.



- Discuss the significance and applications of triangular elements.
 - Two dimensional simple elements are used to find the pressure distribution in a fluid medium. The (x, y) coordinates of nodes i, j and k of an element are given by $(2,4)$, $(4,0)$ and $(2,6)$ respectively. Find the shape functions N_i , N_j and N_k of the element.
- Derive for strain displacement matrix B (4×6) for an axisymmetric element.
- A composite slab consists of three materials of different conductivities is 20 W/mk , 30 W/mk and 50 W/mk of thickness 0.3 m , 0.15 m and 0.15 m respectively. The outer surface is 20°C and the inner surface is exposed to the convective heat transfer coefficient of $25 \text{ W/m}^2\text{k}$ at 300°C . Determine the temperature distribution within the wall.
- Write in general the process of formulation of the thermal stresses in engineering problems.
- Discuss the methodology to solve the Eigen value problem for the estimation of natural frequencies of a stepped bar.

R09

Code: 9A03704

B.Tech IV Year I Semester (R09) Supplementary Examinations, May 2013

INSTRUMENTATION & CONTROL SYSTEMS

(Mechanical Engineering)

Time: 3 hours

Max. Marks: 70

Answer any FIVE questions
All questions carry equal marks

1. Draw a block diagram representation of a generalized measurement system. Identify the various elements and point out the function performed by each element.
2. (a) What are transducers and how are they classified?
(b) Describe the principle of operation of a piezo-electric transducer. Identify the input and output of the system.
(c) List the advantages and disadvantages of capacitive transducers.
3. Explain with a neat sketch the constructional features and working principle of McLeod gauge used for the measurement of low pressures.
4. (a) Distinguish between the direct and indirect modes of level measurement.
(b) Explain the working of capacitive liquid level sensor with a neat sketch.
5. (a) Describe with sketches the basic principle of working of a stroboscope for speed measurement.
(b) Explain the principle of operation of electrical tachometers.
6. (a) Define gauge factor of a resistance strain gauge.
(b) Distinguish between bonded and unbonded type of resistance strain gauge.
7. Explain the working of sling psychrometer for the measurement of humidity.
8. (a) Draw the block diagrams of open loop and closed loop control system and discuss the differences between them.
(b) Briefly explain the working principle of servomechanism.

MECHATRONICS
(Mechanical Engineering)

Time: 3 hours

Max Marks: 70

Answer any FIVE questions
All questions carry equal marks

1. (a) What is simulation? Explain its use in CNL machine tools.
(b) Discuss the important applications of mechatronic systems.
2. (a) What are the desirable characteristics of electronic amplifiers?
(b) Explain the classification of filters based on passing and attenuating of frequencies.
3. (a) Explain in brief about hydraulic actuation systems?
(b) Discuss the factors that have to be considered in a motor selection.
4. (a) What is a CMOS? Explain its function.
(b) Explain the various protection schemes used in mechatronic systems.
5. Write a short notes on the following:
(a) Pulse width modulation.
(b) Variable frequency drives.
6. (a) Explain briefly the difference between microprocessor and microcontroller.
(b) Explain briefly about any one of the analog to digital converter.
7. What is a PLC? How it is different from microcontroller? What are the advantages of PLC compared to a microcontroller?
8. Explain in brief about the following:
(a) Optical incremental encoders.
(b) Robotics.

Code: 9A03708

R09

B.Tech IV Year I Semester (R09) Supplementary Examinations, May 2013

MODERN MANUFACTURING METHODS

(Mechanical Engineering)

Time: 3 hours

Max. Marks: 70

Answer any FIVE questions
All questions carry equal marks

- 1 (a) What do you understand by the term non-traditional machining methods? What is their importance?
(b) Classify the common non-traditional methods. Give a list of such operations.
- 2 (a) Discuss the effects of the following parameters on MRR as applied to USM process:
(i) Amplitude and frequency of vibrations.
(ii) Grain size.
(iii) Applied static load.
(iv) Effect of slurry.
(b) Discuss briefly the advantages and disadvantages of ultrasonic machining.
- 3 (a) With a neat sketch, explain the working principle of abrasive jet machining.
(b) Mention the advantages and applications of water jet machining.
- 4 Explain the principle, working and advantages of electro chemical machining process.
- 5 (a) Explain how the machine tool selections influence the characteristics of spark eroded surface.
(b) Explain the principle of wire EDM.
- 6 (a) Explain the working principles of electron beam machining.
(b) What are the applications of laser beam machining?
- 7 (a) Explain in detail various industrial applications of plasma machining.
(b) What is the principle involved in chemical machining? Explain with suitable sketches.
- 8 What are the various rapid prototyping techniques available commercially? Explain the difference between selective laser sintering and stereo lithography in terms of principle of working.
