

Code : 1G576

IV B.Tech. I Semester Regular Examinations Nov/Dec 2014

Advanced Manufacturing Systems
(Mechanical Engineering)

Max. Marks: 70**Time: 03 Hours**Answer *any five* questions

All Questions carry equal marks (14 Marks each)

1. a) Explain in detail various building blocks of Flexible manufacturing systems? 8M
b) What is an FMS? Why do FMS require major capital expenditure? And why is an FMS capable of producing a wide range of lot sizes? 6M
2. a) Explain in detail why group technology is more important in the present manufacturing scenario? 8M
b) What are the benefits of JIT over the conventional methods? 6M
3. a) Discuss the advantages of using Automated storage systems in a warehouse. 8M
b) Discuss briefly various problems encountered in interfacing handling and storage systems with manufacturing units? 6M
4. a) What are flexible cells? List various desirable attributes of DNC of machine tools. 8M
b) Write short notes on various Quality control tools? 6M
5. a) Define flexibility. Discuss various types of flexibility? 6M
b) Discuss in details various features and advantages of flexible assembly systems 8M
6. a) What are the effects of artificial intelligence on FMS? Discuss. 6M
b) Explain the role of computer simulation for FMS and also discuss its benefits. 8M
7. a) Explain in detail various configurations of FMS. 8M
b) With an example explain various benefits of FMS in various manufacturing areas. 6M
8. a) Describe the overview of Multi model and mixed model flexible lines. 8M
b) Explain the role of information technology in FMS design. 6M

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Automation and Robotics
(Mechanical Engineering)

Max. Marks: 70**Time: 03 Hours**

Answer any five questions

All Questions carry equal marks (14 Marks each)

1. a) Distinguish between fixed automation and flexible automation, clearly highlighting the pros and cons of each of them. 7M
- b) Consider a conveyor as a mechanical part feeding system. Draw the schematic diagram of a conveyor and identify the various elements (the type of sensors required at various locations and their role, motion generators, and transfer elements) in the figure. 7M
2. a) What is meant by buffer storage in a flow line? 2M
- b) Briefly describe the following two cases of storage buffer effectiveness:
- (i) No buffer storage capacity at all 6M
- (ii) Infinite-capacity storage buffers 6M
3. a) Draw the precedence diagram for the assembly line problem outlined in Table.

| Minimum rational work element j | Element time T_{ej} | Must be preceded by: |
|--------------------------------------|--------------------------|----------------------|
| 1 | 0.2 | -- |
| 2 | 0.4 | -- |
| 3 | 0.7 | 1 |
| 4 | 0.1 | 1, 2 |
| 5 | 0.3 | 2 |
| 6 | 0.11 | 3 |
| 7 | 0.32 | 3 |
| 8 | 0.6 | 3, 4 |
| 9 | 0.27 | 6, 7, 8 |
| 10 | 0.38 | 5, 8 |
| 11 | 0.5 | 9, 10 |
| 12 | 0.12 | 11 |

- b) (i) Mention the names of any two software that are useful for computerized line balancing. 2M
- (ii) Briefly describe the role of computer software for improved line balancing. 5M
4. a) Draw the schematic diagram of the PUMA type of industrial robot manipulator, draw its work volume, and identify the various axes of motion of the robot. 7M
- b) A robot with a two-fingered gripper is lifting an object vertically upwards. The gripping force depends on the coefficient of friction between the gripper surface and the object surface. With a schematic diagram and relevant formulae, briefly describe how the gripping force is estimated. 7M

5. a) Write down the general format of the 4×4 homogeneous transformation matrix and its inverse and identify the relevance of the four logical components of the matrices. 7M
- b) Write down the properties of the Jacobian matrix of the robot manipulator clearly highlighting the following:
- (i) The relevance of the Jacobian matrix in mapping velocities between the joint space and the Cartesian space (and vice versa)
 - (ii) The relation between the Jacobian matrix and singularities of the robot manipulator 7M
6. a) Distinguish between point-to-point motion control and continuous path motion control. Also, for each of these two cases, provide the schematic diagram of a typical path and identify any one application each. 6M
- b) Write short notes on the following:
- i) Lead-through programming 4M
 - ii) Via points (Provide schematic diagram) 4M
7. Using relevant schematic diagrams, describe the principle of operation of the following:
- a) Stepper motor 7M
 - b) Absolute encoder 7M
8. Using relevant schematic diagrams, write short notes on the following:
- a) Robotic arc welding 7M
 - b) Peg-in-hole assembly tasks 7M

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R-11

IV B.Tech. I Semester Regular Examinations Nov/Dec 2014

Automobile Engineering
(*Mechanical Engineering*)

Max. Marks: 70

Time: 03 Hours

Answer *any five* questions

All Questions carry equal marks (14 Marks each)

1. a) Explain the functions of various components of four wheel drive. 7M
b) Discuss in brief about the concepts of turbo charging and super charging. 7M
2. a) What are the requirements of diesel injection system? 7M
b) Give short notes on gasoline injection. 7M
3. a) Describe the operation of a thermostat. What are the advantages of using a thermostat in the cooling system? 7M
b) Explain with a neat sketch the working principle of evaporative cooling system used in automobile. 7M
4. a) What are the methods used to control diesel particulate emissions? 9M
b) Discuss the effects of emissions on human health. 5M
5. What are the various types of starting drives in automobile engine? Explain with neat sketch any one type of starting drive. 14M
6. a) What are the functions of a clutch used in automobiles? 7M
b) What are the different types of clutches used in an automobile? Briefly explain about them. 7M
7. Discuss in detail about the principle and operation of Ackerman and Davis steering gear mechanism. 14M
8. What is the purpose of independent suspension system? How is it achieved in front and rear axles? 14M

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Finite Element Methods
(Mechanical Engineering)

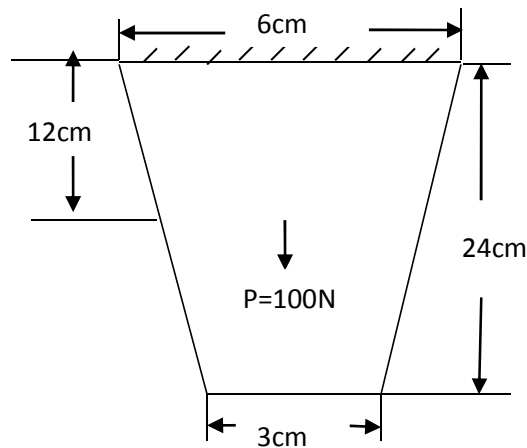
Max. Marks: 70

Time: 03 Hours

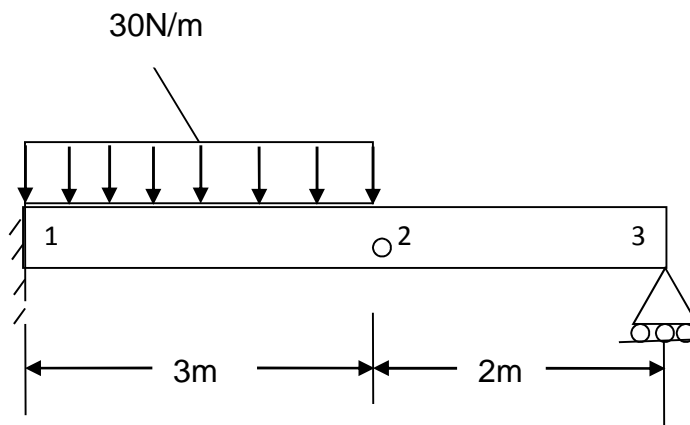
Answer any five questions

All Questions carry equal marks (14 Marks each)

1. Discuss the generalized procedure of FEM. 14M
2. Consider the thin (steel) plate shown in figure. The plate has a uniform thickness $t = 1$ cm, Young's modulus $E = 200$ GPa and the mass density $\rho = 7800$ kg/m³. In addition to its self-weight, the plate is subjected to a point load $P = 100$ N at its midpoint.
 - a) Using Elimination approach, solve for the global displacement vector
 - b) Evaluate stresses in each element
 - c) Determine the reaction force at the support.



3. a) What is a Truss element? 14M
- b) Derive the element stiffness matrix of a Truss bar element. 2M
4. For the loaded beam shown in figure, determine the slope and deflection at node 2 using the finite element concept. 12M



Take $EI = 900$ Nm² 14M

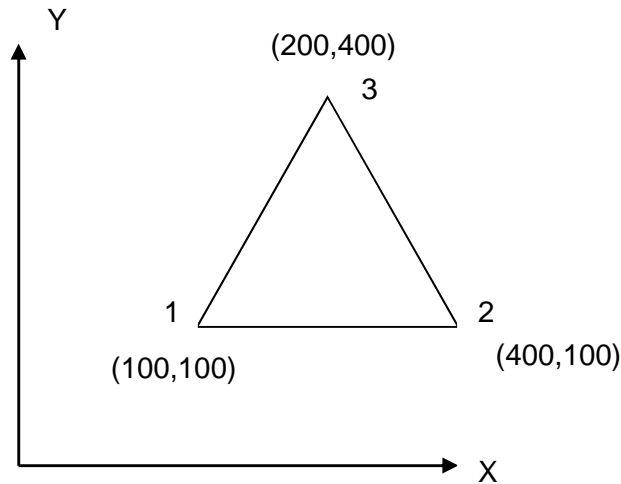
5. For the plane stress element shown in figure, the nodal displacements are

$$u_1 = 2\text{mm} \quad v_1 = 1\text{mm}$$

$$u_2 = 1\text{mm} \quad v_2 = 1.5\text{mm}$$

$$u_3 = 2.5\text{mm} \quad v_3 = 0.5\text{mm}$$

Determine the element stresses (σ_x , σ_y and τ_{xy}). Assume $E=200\text{GN/m}^2$, $\nu=0.3$ and $t=10\text{mm}$.



14M

6. a) What is the significance of numerical integration? 7M
 b) Use Gaussian Quadrature to obtain an exact value for the Integral

$$\int_{-1}^1 \int_{-1}^1 (r^3 - 1) (s - 1)^2 dr ds$$

7M

7. A composite wall consists of three materials of different thermal conductivities i.e., 20W/m-k, 30 W/m-k, 50 W/m-k of thickness 0.3m, 0.15m, 0.15m respectively. The outer surface is 20 C and the inner surface is exposed to the convective heat transfer coefficient 25W/m²-k at 300 C. Determine the temperature distribution within the wall. 14M

8. Find the natural frequency of a cantilever beam vibrating freely in the axial direction, the exact solution is $\omega_n = \frac{n\pi}{2L} \sqrt{\frac{E}{\rho}}$. Use lumped mass formulation.



14M

Operations Research
(Mechanical Engineering)

Max. Marks: 70**Time: 03 Hours**

Answer any five questions

All Questions carry equal marks (14 Marks each)

1. a) Explain the Phases of OR 4M
- b) A manufacturer makes two products A and B each of which is processed through four departments 1, 2, 3 and 4 in some order. Product A could be manufactured either by passing it through departments 1 – 3 – 4 or 2 – 3 – 4, product B needs processing through departments 2 – 3 – 4 only. Their rates of processing in the department and profit per unit product are given as under:

| Product | Profit Rs./unit | Rates of process units / week departments | | | |
|---------|--------------------|--|-----|---|----|
| | | 1 | 2 | 3 | 4 |
| A | 400 | 5 | --- | 5 | 10 |
| A | 430 | --- | 4 | 5 | 5 |
| B | 500 | --- | 2 | 5 | 8 |

The company works on 50 week year basis but down time in the department varies and expected number of production weeks from departments 1, 2, 3 and 4 are 45, 42, 48 and 45 respectively. There is a sales commitment of 100 units of product A and 60 units of product B every year. Formulate into LPP. 10M

2. a) Differentiate between Assignment and Transportation problems. 4M
- b) Power stations $P_j, j = 1, 2, 3, 4$ run on coal found in mines, $Q_i, i = 1, 2, 3$. Quantity of coal at Q_i is A_i . Max. possible production of power at P_j is B_j . The cost of production of unit quantity of coal at Q_i is C_i and its cost of transportation to P_j is C_{ij} . A unit quantity of coal produces H_j units of power at P_j . How should the coal be distributed so that the total cost of coal at power station is minimum, How much is the power produced at each station. Solve the problem for the following data.

| | P_1 | P_2 | P_3 | P_4 | A_i | C_i |
|-------|---------------|---------------|-------|---------------|-------|-------|
| Q_1 | 4 | 3 | 2 | 1 | 750 | 10 |
| Q_2 | 3 | 5 | 6 | 2 | 350 | 15 |
| Q_3 | 0 | 4 | 3 | 3 | 400 | 20 |
| B_j | 100 | 150 | 300 | 200 | | |
| H_i | $\frac{1}{2}$ | $\frac{1}{2}$ | | $\frac{1}{4}$ | | |

10M

3. A computer contains 1000 resistors. When a resistor fails it is replaced. The cost of replacing of resistor individually is Rs. 1 /-. If all the resistors are replaced at the same time the cost/ resistor is reduced by 65 paise. The probability of survival at the end of the month is given below. What is the optimum replacement plan?

| Month | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|-------------------------|---|------|-----|-----|-----|------|---|
| Probability of Survival | 1 | 0.97 | 0.9 | 0.7 | 0.3 | 0.15 | 0 |

14M

4. A mechanic is to be hired to repair machines which break down at an average rate of 3/hr. Break downs are distributed in time in a manner that may be regarded as Poisson. The non – productive time on any machine is considered to cost the company Rs. 5/hr. The company has narrowed the choice to 2 mechanics A and B. The mechanic A repairs the machines at an average rate of 4/hr and he will demand Rs. 3/hr. The mechanic B costs Rs. 5/hr and can repair the machines exponentially at an average rate of 6/hr. Decide which mechanic should be hired. 14M
5. The following matrix represents the payoff P_1 in a rectangular game between two player P_1 and P_2

| | | P_2 | | | |
|-------|-----|-------|----|-----|----|
| | | I | II | III | IV |
| P_1 | I | 8 | 15 | -4 | -2 |
| | II | 19 | 15 | 17 | 16 |
| | III | 0 | 20 | 15 | 5 |

by notion of dominance reduce the game to 2x4 and then solve graphically

14M

6. a) Explain the following terms with respect to inventory control
- I. Lead Time
 - II. Reorder level
 - III. Safety Stock
 - IV. Ordering cost
- 4M
- b) A Company buys 2500 units/year. The annual unit inventory carrying cost is estimated at 20% and the ordering cost is Rs. 10 per order placed. The price quoted by the supplier is Rs. 1 / unit subject to discount of 5% for order of 1000-1999 and 7% for orders of 2000 or more. Is it worthwhile to increase the discount order substantiate your answer? 10M
7. a) Define Simulation 4M
- b) Explain the phases of simulation 4M
- c) How do apply simulation technique to the Queuing models 6M
8. Use Bellman's principle optimality of find the optimum solution to the following problem.

$$\text{Minimize } Z = y_1^2 + y_2^2 + y_3^2$$

Subject to the constraints

$$y_1 + y_2 + y_3 = 15 \text{ and } y_1, y_2, y_3 \geq 0.$$

14M

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Un Conventional Machining Process*(Mechanical Engineering)***Max. Marks: 70****Time: 03 Hours**Answer *any five* questions

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1. a) What situations the unconventional machining processes are employed? 7M
b) Classify the common non- traditional machining methods. Give a list of such operations. 7M
2. a) Explain the principle and working of Ultrasonic machining process. List out the advantages and applications of the process 8M
b) What are the process variables which effect MRR[material removal rate] in USM 6M
3. a) With a neat sketch, explain the working principle of abrasive jet machining, discuss parameters which govern process performance. 8M
b) Compare WJM,WAJM & AJM 6M
4. a) Explain the principle, working and advantages of Electro chemical machining [ECM] process. 8M
b) What are the requirements of electrolytes employed in ECM 6M
5. a) Explain working of Spark erosion machining, and state why more erosion takes place at positive electrode 8M
b) Compare sinker EDM with wire EDM. 6M
6. a) Describe process of Electron beam machining, state its applications, limitations 7M
b) Describe process of Laser beam machining, state its applications & limitations 7M
7. a) Describe plasma arc machining, state its industrial applications 7M
b) Describe the process of chemical machining, state the advantages and limitation 7M
8. a) Describe Magnetic abrasive finishing, and state its applications 7M
b) What is Rapid prototyping? Explain the process of Stereo lithography for manufacturing prototypes 7M
