IV B.Tech. I Semester Regular Examinations Nov/Dec 2017
Automation and Robotics
(Mechanical Engineering)

Max. Marks: 70   Time: 3 Hours
Answer *all five* units by choosing one question from each unit (5 x 14 = 70 Marks)
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UNIT–I

1. With a block diagram, describe the various levels of automation.   14M

OR

2. Outline the features of various types of flow lines and their advantages.   14M

UNIT–II

3. Outline the following with relevant schematic diagrams:

    a) Flexible assembly line   7M

    b) ANY ONE method for design for automated assembly   7M

OR

4. Using an illustrative example, describe ANY ONE method of assembly line balancing.   14M

UNIT–III

5. SCARA and PUMA configurations are extremely popular for industrial applications in automobile manufacturing and electronics assembly, respectively. What are the advantages of these robots in terms of the following:

    (i)   Size and geometry of work volume,   4M

    (ii)   Load carrying capacity,   3M

    (iii)   The type of joint axes, and   4M

    (iv)   Versatility of applications.   3M

OR

6. a) i) What is meant by term *degrees of freedom* of robot manipulator?   2M

        ii) How is it related to the number of axes of an industrial manipulator?   2M

    b) Draw a two-fingered robot gripper holding an object of weight W in the shape of a rectangular prism. The major axis of the object is vertical. If the coefficient of friction is $\sim$, outline the procedure for estimation of the gripping force F_g to be applied normal to the gripping surface by each finger.   10M

UNIT–IV

7. a) Write down the general format of the 4×4 homogeneous transformation matrix and identify the four logical components of the matrix and their purpose.   7M

    b) Using a planar two-link manipulator as the example and using relevant illustrative diagrams, outline the concept of inverse kinematics and existence of multiple solutions ($_1$, $_2$) in the joint space for a given point (x,y) to be reached in the world space by the end-effector.   7M

OR

8. a) Using schematic diagrams and conceptual description, distinguish between path and trajectory.   6M

    b) Illustrate the use of via points on the robot tool path for the purpose of obstacle avoidance.   8M

UNIT–V

9. Using relevant diagrams, describe the principle of a stepper motor, clearly highlighting the following:

    (i)   Constructional features involving alternate NORTH and SOUTH poles and their role in producing stepping motion of the rotor   7M

    (ii) Relation between resolution of the stepper motor and the number of poles   3M

    (iii) Half-stepping and micro-stepping   4M

OR

10. a) Distinguish between online programming and offline programming, outlining the use of a teach-pendant or a special software, as the programming tool.   8M

    b) What is meant by the following?

        (i)   pick-and-place operation   3M

        (ii) palletizing   3M

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IV B.Tech. I Semester Regular Examinations Nov/Dec 2017
Automobile Engineering
(Mechanical Engineering)

Max. Marks: 70   Time: 3 Hours
Answer *all five* units by choosing one question from each unit (5 x 14 = 70 Marks)
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UNIT–I

1. a) On a hilly track, the performance of a rear wheel driven vehicle is superior compared to front wheel drive vehicle. Explain the reasons.   7M

   b) What are the different types of oil pumps in the engine lubrication? Describe any one of the oil pumps with a neat sketch.   7M

OR

2. a) Give the list of various electrical components used in an automobile and give their functions.   7M

   b) Explain the working of current –voltage regulator   7M

UNIT–II

3. a) What is the A/F mixture requirements at different loads and speeds for automobile engine?   7M

   b) Name the different methods of fuel injection system. Explain airless solid injection system in C.I engines.   7M

OR

4. a) What are the sources of HC formation in petrol engines? Explain various factors which effect the HC formation.   7M

   b) Explain the suitability of LPG and CNG in automobile engines.   7M

UNIT–III

5. a) Explain with a neat sketch the working principle of evaporative cooling system used in automobile.   7M

   b) What is the main use of using a thermostat in the cooling system? Explain.   7M

OR

6. a) What are the advantages of battery ignition system over magneto ignition system?   7M

   b) Explain how spark advance and retard mechanisms are employed in an automobile?   7M

UNIT–IV

7. a) Explain the construction, working and performance of a fluid flywheel.   7M

   b) How torque tube drive is different from Hotch kiss drive?   7M

OR

8. With neat sketches explain the working principle of constant mesh gear box & sliding mesh gear box. Give the differences between these two.   14M

UNIT–V

9. a) How camber, castor, toe-in, toe-out will have the effect on the stability of the vehicle? Explain.   7M

   b) Designing of a suspension system mainly depends on sprung weight and un sprung weight of an automobile. Justify.   7M

OR

10. a) Explain different types of steering linkages with neat sketches.   7M

   b) What is ABS? Explain how ABS will provide good control over the vehicle?   7M

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IV B.Tech. I Semester Regular Examinations Nov/Dec 2017
Advanced Manufacturing Systems
(Mechanical Engineering)

Max. Marks: 70   Time: 3 Hours
Answer all five units by choosing one question from each unit (5 x 14 = 70 Marks)
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UNIT–I

1. a) Explain FMS Implementation with neat sketch.   7M
   b) What are the benefits of FMS and explain the need of FMS in modern manufacturing environment.   7M

OR

2. a) "Flexible Manufacturing System is far more versatile than Flexible Manufacturing Cell." – Justify   7M
   b) Discuss the important factors to be considered while designing FMS.   7M

UNIT–II

3. a) Define group technology. What are the reasons for adopting GT?   7M
   b) Define Kanban. Explain two types of Kanban system.   7M

OR

4. a) Elaborate the operational issues related to FMS.   6M
   b) With the help of a line diagram explain the layout of group technology.   8M

UNIT–III

5. a) What are the applications of robot and their merits in FMS?   7M
   b) Explain AGVs with its different guide path.   7M

OR

6. a) Explain the working principle of cleaning station.   7M
   b) Describe in detail about control aspects of FMS.   7M

UNIT–IV

7. a) Discuss any four types of FMS flexibility in detail.   8M
   b) List the capabilities of manufacturing system should possess to become Flexible assembly Systems and explain in detail.   6M

OR

8. a) Short notes on (i) Dynamic Manufacturing Systems (ii) IT facilitated flexibility   4M
   b) Classify Flexible manufacturing systems based on level of flexibility   10M

UNIT–V

9. a) With a case study, explain the application of FMS in any manufacturing Industry   7M
   b) Discuss the importance of automated material handling devices used in an FMS.   7M

OR

10. a) Discuss the stages in FMS simulation with an example.   8M
    b) Describe the operational issues in FMS   6M
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IV B.Tech. I Semester Regular Examinations Nov/Dec 2017
Finite Element Methods
(Mechanical Engineering)

Max. Marks: 70   Time: 3 Hours
Answer *all five* units by choosing one question from each unit (5 x 14 = 70 Marks)
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UNIT–I

1. a) Discuss how finite element method is evolved in the engineering field.   7M
    b) Discuss the advantages and disadvantages of Finite Element method   7M
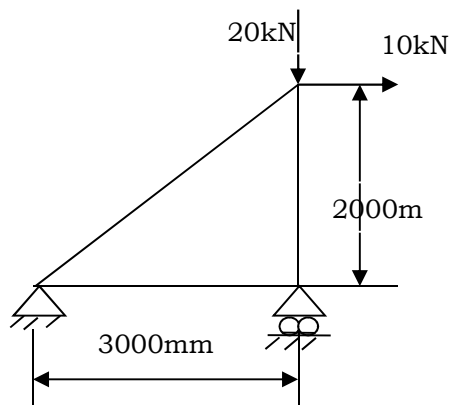
OR

2. For the vertical bar shown in figure, find the deflection at 'A' and the stress distribution. Use E=150MPa and weight per unit volume=0.05N/cm^3.
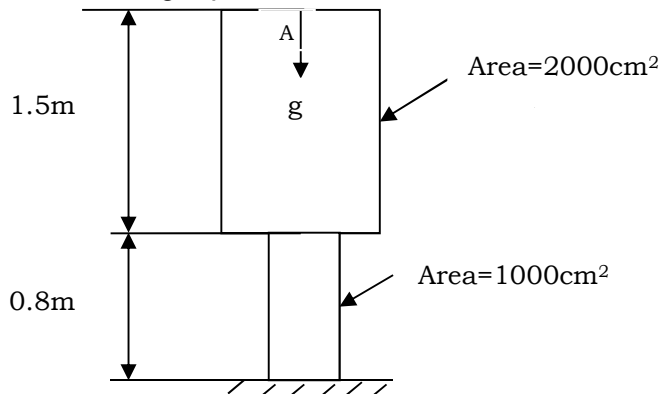
14M

UNIT–II

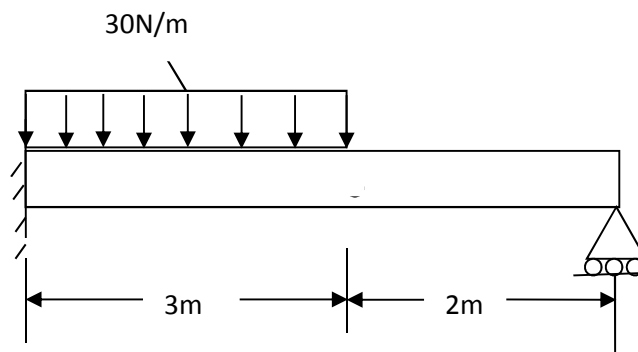3. Consider the plane truss shown in figure, determine the nodal displacements, element forces and support reactions. Take E=2X10^5 N/mm^2; A= 1500mm^2.

14M

OR

4. For the loaded beam shown in figure, determine the slope at the roller support and deflection at the mid-span using the finite element concept.

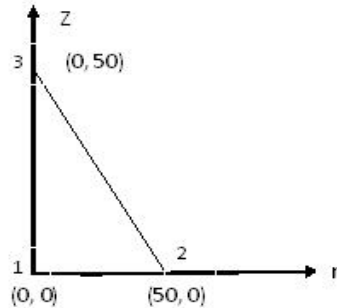**Take EI= 900N-m^2**   14M

UNIT–III

5. Derive stiffness matrix for CST element. 14M

OR

6. For axisymmetric element shown in figure, determine the stiffness matrix. Let $E=2.1 \times 10^5 N/mm^2$ and = 0.25. The co-ordinates shown in figure are in millimeters.

14M

UNIT–IV

7. a) Define Iso-parametric element, Sub-parametric element and Super parametric element. 4M

   b) Consider isoparametric quadrilateral element shown in figure, map the point r = 0.5, s= 0 in the parent element to the corresponding physical point in the quadrilateral element.
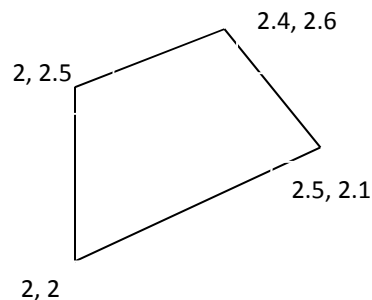
10M

OR

8. A composite wall consists of three materials of different thermal conductivities i.e., 20 W/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

UNIT–V

9. Derive lumped matrix formulation for bar and beam element. 14M

OR

10. Using single finite element determine the natural frequency of vibrations of a cantilever beam of length 'L'. 14M

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IV B.Tech. I Semester Regular Examinations Nov/Dec 2017
Operations Research
(Mechanical Engineering)

Max. Marks: 70   Time: 3 Hours

Answer *all five* units by choosing one question from each unit (5 x 14 = 70 Marks)

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UNIT–I

1. ABC Printing company is facing a tight financial squeeze and is attempting to cut costs wherever possible. At present it has only one printing contract, and luckily, the book is selling well in both the handcover and paperback editions. It has just received a request to print more copies of this book in either the hand cover or the paperback form. The printing cost for the handcover books is Rs 600 per 100 books while that for paperback is only Rs 500 per 100. Although the company is attempting to economize, it does not wish to lay off any employee. Therefore, it feels obliged to run its two printing presses - I and II, at least 80 and 60 hours per week, respectively. Press I can produce 100 handcover books in 2 hours or 100 paperback books in 1 hour. Press II can produce 100 handcover books in 1 hour or 100 paperbacks in 2 hours. Determine how many books of each type should be printed in order to minimize costs.   14M

OR

2. Use penalty (Big-M) method to solve following LP problem.

$$Min \ Z = 2X_1 + X_2$$
$$subject \ to \ \ 3X_1 + X_2 = 3$$
$$4X_1 + 3X_2 \geq 6$$
$$X_1 + 2X_2 \leq 4$$
$$and \ \ \ \ \ \ \ \ X_1, X_2 \geq 0$$

14M

UNIT–II

3. A steel company has three open hearth furnaces and five rolling mills. The transportation costs (rupees per quintal) for shipping steel from furnaces to rolling mills are given in the following table:

	M_1	M_2	M_3	M_4	M_5	Supply
F_1	4	2	3	2	6	8
F_2	5	4	5	2	1	12
F_3	6	5	4	7	7	14
Demand	4	4	6	8	8	

What is the optimal shipping schedule?   14M

OR

4. a) Explain the differences between a transportation problem and an assignment problem.   6M

b) An automobile dealer wishes to put four repairmen to four different jobs. The repairmen have somewhat different kinds of skills and they exhibit different levels of efficiency from one job to another. The dealer has estimated the number of man-hours that would be required for each job-man combination. This is given in the following table. Find the optimal assignment that will result in minimum man-hours needed.

		Jobs A	B	C	D
Men	1	5	3	2	8
	2	7	9	2	6
	3	6	4	5	7
	4	5	7	7	8

8M

UNIT–III

5. A computer contains 10,000 resistors. When any resistor fails, it is replaced. The cost of replacing a resistor individually is Re 1 only. If all the resistors are replaced at the same time, the cost per resistor would be replaced to 35 paise. The percentage of surviving resistors say S(t) at the end of month t and the probability of failure P(t) during the month t are as follows:

t	:	0	1	2	3	4	5	6
S(t)	:	100	97	90	70	30	15	0
P(t)	:	-	0.03	0.07	0.20	0.40	0.15	0.15

14M

OR

6. a) Explain the theory of dominance in the solution of rectangular games. 4M

 b) Solve the game whose payoff matrix is given below:

		Player B				
		B_1	B_2	B_3	B_4	B_5
Player A	A_1	2	4	3	8	4
	A_2	5	6	3	7	8
	A_3	6	7	9	8	7
	A_4	4	2	8	4	3

10M

UNIT–IV

7. On an average 96 patients per 24 hour-day require the service of an emergency clinic. Also on an average, a patient requires 10 minutes of active attention. Assume that the facility can handle only one emergency at a time. Suppose that it costs the clinic Rs 100 per patient treated to obtain an average service time of 10 minutes, and that each minute of decrease in this average time would cost Rs 10 per patient treated, how much would have to be budgeted by the clinic to decrease the average size of the queue from 4/3 patients to 1/2 patient. 14M

OR

8. Find the optimal order quantity of a product for which the price breaks are as follows:

Quantity (Units)	Price per Unit (Rs)
$0 < Q_1 < 500$	10.00
$200 \leq Q_2 < 750$	9.25
$750 \leq Q_3$	8.75

The monthly demand of the product is 250 units. The storage cost is 2 % of the unit cost and the cost of ordering is Rs 350. 14M

UNIT–V

9. Solve following Linear Programming Problem using Dynamic Programming.

$Maximize\ Z = 3X_1 + 5X_2$

$subject\ to \quad X_1 \leq 4 \qquad X_2 \leq 6 \qquad 3X_1 + 2X_2 \leq 18 \qquad X_1, X_2 \geq 0$

14M

OR

10. A firm has a single channel service station with the following arrival and service time probability distribution:

Inter arrival time (min)	Probability	Service time (min)	Probability
10	0.10	5	0.08
15	0.25	10	0.14
20	0.30	15	0.18
25	0.25	20	0.24
30	0.1	25	0.22
---	---	30	0.14

The customer's arrival at the service station is a random phenomenon and the time between arrivals varies from 10 to 30 minutes. The service time varies from 5 to 30 minutes. The queuing process begins at 10 a.m. and proceeds for nearly 8 hours. The queue discipline is first-come first-served. Simulate this queue for 10 arrivals.

Random numbers for arrival time: 20, 73, 30, 99, 66, 83, 32, 75, 04, 15.

Random numbers for service time: 26, 43, 98, 87, 58, 90, 84, 60, 08, 50. 14M

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IV B.Tech. I Semester Regular Examinations Nov/Dec 2017
Un conventional Machining Process
(Mechanical Engineering)

Max. Marks: 70   Time: 3 Hours
Answer all five units by choosing one question from each unit (5 x 14 = 70 Marks)
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UNIT-I

1. a) List the unconventional machining process under mechanical energy, thermal energy and chemical energy category.   7M
   b) What are the main parameters to be considered while selecting a particular unconventional machining process and why?   7M

OR

2. a) Explain the importance of Unconventional Machining Processes.   7M
   b) Discuss the classification of Unconventional Machining Processes.   7M

UNIT-II

3. a) Draw the schematic layout of abrasive jet machine and explain its operational characteristics. What are the methods adopted to have an effective control over the mass flow rate of the abrasive.   10M
   b) What are the applications of water jet machining?   4M

OR

4. a) Plot and discuss the following relationship for USM
      i. Particle size Vs Material removal rate
      ii. Particle Velocity Vs Material removal rate
      iii. Frequency Vs Material removal rate   9M
   b) What are the advantages and limitations of Ultrasonic machining?   5M

UNIT-III

5. a) Explain the electrochemical deburring and honing processes in detail.   7M
   b) Calculate the metal removal rate in mm^3/min in Electrochemical machining of a material having density 8000 kg/m, atomic wt 56, valence 2 when current used is 1000 A and Faraday constant is 96500 columb/mole.   7M

OR

6. a) What are the advantages of Electro Chemical Machining process?   7M
   b) What are the tool design aspects in Electro Chemical Machining process?   7M

UNIT-IV

7. a) How will you carry out the analysis for optimization of metal removal rate in EDM process?   7M
   b) What are the functions of dielectric fluid used in Electric Discharge Machining?   7M

OR

8. a) Explain the mechanism of EDM showing the circuit and movements of ions.   10M
   b) Discuss the advantages and disadvantages of electro discharge grinding.   4M

UNIT-V

9. a) Discuss in detail about the thermal features of LBM and explain the construction and working of LBM.   7M
   b) Distinguish between the electron beam machine and laser beam machine   7M

OR

10. a) Explain metal removal mechanism in Plasma Arc machining with neat sketch.   7M
    b) Discuss the factors that influence the quality of the cut in PAM.   7M

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