Hall Ticket Number :										

R-14

Code: 4PE522

M.Tech. II Semester Regular & Supplementary Examinations June 2017

Robotics

(Machine Design)

Max. Marks: 60 Time: 3 Hours

Answer *all five* units by choosing one question from each unit (5 x 12 = 60 Marks)

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UNIT–I

1. a) Suggest a suitable robot for assisting in gardening. Illustrate the different activities it can perform and suggest the components of the robot as per the activity. 8M
   b) Suggest suitable robotic configuration and components for assembling spare parts of an automobile. 4M

OR

2. a) Identify the types of end-effectors suitable for sweeping city roads by a robot? Explain the working principle of garbage collection, end-effector material and design for the purpose. 8M
   b) Discuss Homogeneous Transformation matrices? 4M

UNIT–II

3. a) "The forward kinematic model of a manipulator depends on the choice of the home position of the manipulator" Comment on this statement 8M
   b) Solutions to inverse kinematics problem are generally difficult. Explain why? 4M

OR

4. a) Describe D-H representation of forward kinematic equations of robots? 4M
   b) Explain Inverse Kinematic equations for position of 6-DOF manipulator? 8M

UNIT–III

5. a) Explain differential motions of frame-translations? 6M
   b) Discuss relation between Jacobian and the differential operator? 6M

OR

6. a) Derive Lagrange robot equations for a 3-DOF manipulator? 6M
   b) Compute the Jacobian for the SCARA manipulator? 6M

UNIT–IV

7. a) A single cubic trajectory is given by $\theta(t) = 20 + 25\ t^2 + 40\ t^3$ and is used over a time interval from $t = 0$ to $t = 2$ seconds. What are the starting and final positions, velocities and accelerations? 6M
   b) Explain Basic principle of Optical proximity sensor? 6M

OR

8. a) A rotary joint moves from -15^0 to $+45^0$ in 3seconds. Determine the polynomial for a smooth trajectory, if the initial and final velocity and accelerations are zero. 6M
   b) While designing a robot for painting purpose explain the technical aspects that need to be considered and list the Sensors to be chosen to complete the required task. 6M

UNIT–V

9. a) Discuss Wait, Signal and Delay commands? 6M
   b) Explain generations of robot programming languages? 6M

OR

10. a) Describe methods of robot programming? 6M
    b) Discuss robot language structure with help of block diagram? 6M

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Hall Ticket Number :										

R-14

Code: 4PF523

M.Tech. II Semester Regular & Supplementary Examinations June 2017

Theory of Plasticity

(Machine Design)

Max. Marks: 60 Time: 3 Hours

Answer *all five* units by choosing one question from each unit (5 x 12 = 60 Marks)

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UNIT–I

1. Derive 3D equilibrium equation in Cartesian co-ordinate system 12M

OR

2. The state of stress at appoint is given by the following stress tensor:

$$^{2}_{ij} = \begin{bmatrix} 50 & 50 & -40 \\ 50 & -30 & 30 \\ -40 & 20 & -100 \end{bmatrix} N/mm^2$$

i) Calculate the stress invariants

ii) Magnitude and direction of principal stress 12M

UNIT–II

3. Explain the convexity and uniqueness for an elastic solid 12M

OR

4. a) Explain elastic and plastic strain increment tensors 6M

b) Explain the concept of plastic potential 6M

UNIT–III

5. Explain the Prandtl - Reuss Material Model. 12M

OR

6. What are isotropic and kinematic hardening rules? Explain 12M

UNIT–IV

7. Explain the steps involved in finite element model for plasticity 12M

OR

8. Write algorithms for Numerical implementations of the elastic plastic incremental stress-strain relations. 12M

UNIT–V

9. State and explain lower bound theorem and upper bound theorem 12M

OR

10. Explain the Statically admissible stress field and kinematically admissible velocity field. 12M

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Hall Ticket Number :										

R-14

Code: 4PE521

M.Tech. II Semester Regular & Supplementary Examinations June 2017

Advanced Optimization Techniques

(Machine Design)

Max. Marks: 60 Time: 3 Hours

Answer *all five* units by choosing one question from each unit (5 x 12 = 60 Marks)

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UNIT–I

1. a) The following relationships are arrived for calculation revenue and cost values/functions of concern. Find out at what level of output value of x, where x is measured in tons produced per week, Profit (Revenue-Cost) value is maximum. 6M

   b) Find the maximum of the function $f(\mathbf{X})=2x_1+x_2+10$ subject to $g(\mathbf{X}) = x_1+2x_2^2=3$ using the Lagrange multiplier method. Also examine the effect of changing the right-hand side of the constraint on the optimum value of *f*. 6M

OR

2. a) Determine the maximum and minimum values of the function
   $f(x) = 12x^5 - 45x^4 + 40x^3 + 5$ 6M

   b) Consider the following problem:
   Minimize $f(x_1, x_2) = (x_1 - 1)^2 + x_2^2$
   subject to
   $g_1(x_1, x_2) = x_1^3 - 2x_2 \le 0$
   $g_2(x_1, x_2) = x_1^3 + 2x_2 \le 0$
   Determine whether the constraint qualification and the Kuhn–Tucker conditions are satisfied at the optimum point. 6M

UNIT–II

3. Solve the following LPP using Big-M method.
   Minimize $Z=4x_1+2x_2$, Subject to: $3x_1+x_2\ge27$ and $-x_1-x_2\le-21$ and x_1, x_2 are ≥0. 12M

OR

4. Five jobs are to be assigned to five machines using the return matrix provided below. Assign the jobs to machines to maximize total returns.

		Machines Returns in Rs.				
		A	B	C	D	E
Jobs	P	5	11	10	12	4
	Q	2	4	6	3	5
	R	3	12	5	14	6
	S	6	14	4	11	7
	T	7	9	8	12	5

12M

UNIT–III

5. Find minimum point for the following function using the Nelder-Mead algorithm:
$f(x) = x_1^2 - 7x_1 - x_1x_2 + x_2^2 - x_2$, Use x=(1,1) as the initial seed point. 12M

OR

6. a) State the necessary and sufficient conditions for the unconstrained minimum of a function. 4M

   b) Minimize $f(x_1, x_2) = x_1 - x_2 + 2x_1^2 + 2x_1x_2 + x_2^2$ starting from the point **X**1 = [0,0], Solve by steepest descent method. 8M

UNIT–IV

7. a) Explain stages involved in Genetic Algorithm through a flowchart. 4M

   b) Explain Genetic Algorithm with a suitable example, considering one complete iteration. 8M

OR

8. Illustrate the following operators considering a simple problem of sequencing.
   a. Reproduction or Selection Operator
   b. Crossover operator
   c. Mutation Operator
   12M

UNIT–V

9. a) How Genetic Algorithm differs from Genetic Programming. 4M

   b) Solving a Differential equation given below using Genetic Programming

$$\frac{dy}{dx} + y\,\mathrm{Cos}\,x = 0,$$

where $y_{initial} = 1.0$ for $x_{initial}$ of 0.0. 8M

OR

10. Explain the procedure optimizing the sequence of operation in machining. 12M

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Hall Ticket Number :										

R-14

Code: 4PF524

M.Tech. II Semester Regular & Supplementary Examinations June 2017

Design for Manufacturing

(Machine Design)

Max. Marks: 60 Time: 3 Hours

Answer *all five* units by choosing one question from each unit (5 x 12 = 60 Marks)

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UNIT–I

1. a) What is design philosophy? 4M

   b) Explain the principles which are to be followed while designing a product considering the economical aspects. 8M

OR

2. a) As a design engineer discuss the relationship between material selection and process selection for a given component. 6M

   b) Distinguish between design for manufacturing and detailed design explaining the various terms involved. 6M

UNIT–II

3. a) Briefly discuss redesigning of components for machining ease with the help of an example. 6M

   b) What are the general design recommendations given for machined parts? 6M

OR

4. a) Discuss the features that facilitate machining with suitable examples. 6M

   b) Discuss the various machining processes in design aspect. 6M

UNIT–III

5. What are general design considerations for casting processes with respect to
   a) Economical molding b) Solidification c) Surface integrity
   d) Fettling and cleaning 12M

OR

6. Enumerate design rules and guidelines applicable to casting tolerances. 12M

UNIT–IV

7. a) What are the design factors to be considered for forging operation? Explain. 6M

   b) Explain the effect of thermal stresses in weld joints. 6M

OR

8. a) Briefly discuss the design of brazed joints. 6M

   b) Determine the shape and position of parting line in the design of forging die. 6M

UNIT–V

9. a) Explain Keeler Goodman forging line diagram. 6M

   b) Discuss the design principles for deep drawing process. 6M

OR

10. a) What is visco-elastic behavior of materials? Explain in detail. 6M

    b) Give a note on design considerations for injection moulding. 6M

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Hall Ticket Number :										

R-14

Code: 4PF522

M.Tech. II Semester Regular & Supplementary Examinations June 2017

Mechanics of Composite Materials

(Machine Design)

Max. Marks: 60 Time: 3 Hours

Answer *all five* units by choosing one question from each unit (5 x 12 = 60 Marks)

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UNIT–I

1. a) Compare the Metal Matrix composites and Ceramic Matrix Composites 8M
   b) What are the advantages of Polymer matrix composites? 4M

OR

2. a) Summarize the advantages of fiber reinforcement. 6M
   b) Explain about natural composites. 6M

UNIT–II

3. Explain the Autoclave and Filament Winding processes with neat sketch. 12M

OR

4. Explain stiffness and compliance matrices for orthotropic materials. 12M

UNIT–III

5. Determine the longitudinal modulus E_1 and the longitudinal tensile strength F_{1t} for a unidirectional carbon/epoxy composites with the following properties. V_f = 0.65, E_{1f}=235 GPa, E_m=4.14 GPa, F_{ft}=3450 MPa and F_{mt}= 104 MPa. 12M

OR

6. Explain the hydrothermal strains in unidirectional lamina. 12M

UNIT–IV

7. Explain the upper bound technique determine to Young's modulus. 12M

OR

8. The measured coefficients of thermal expansion of a unidirectional carbon/epoxy composites of fiber volume ratio Vf = 0.65 are $\alpha_1 = -0.9 \times 10^{-6}$/°C and $\alpha_2 = 27 \times 10^{-6}$/°C. Determine the coefficients α_{1f} and α_{2f} of the fiber from the above and the following constituent properties V_f = 0.20, V_m = 0.34, E_{1f}= 235 GPa, E_m= 4.1 GPa and $\alpha_m = 41 \times 10^{-6}$/°C. 12M

UNIT–V

9. a) Explain the inter-laminar stresses in a laminated composites. 8M
   b) Write notes on warpage of laminates. 4M

OR

10 Explain the design of laminated composite with other mechanical design issues. 12M

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Hall Ticket Number :										

R-14

Code: 4PF521

M.Tech. II Semester Regular & Supplementary Examinations June 2017

Mechanical Vibrations

(Machine Design)

Max. Marks: 60 Time: 3 Hours

Answer *all five* units by choosing one question from each unit (5 x 12 = 60 Marks)

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UNIT–I

1. a) Find the natural frequency of a vibratory system having a mass suspended from the free end of a massless spring. What is the effect of inertia of the spring mass? 6M

   b) Define the terms: damping coefficient, critical damping coefficient and damping factor. 6M

OR

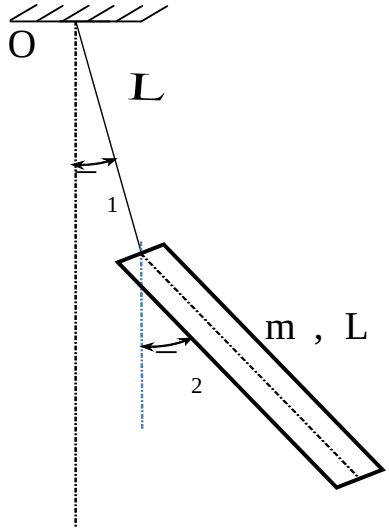
2. A 5-kg mass attached to the lower end of a spring whose upper end is fixed vibrates with a natural period of 0.5s.Determine the natural period when a 2.5 kg mass is attached to the midpoint of the same spring with the upper and lower ends fixed. 12M

UNIT–II

3. Write short notes on VIbrometers, accelerometers and velocity meters. 12M

OR

4. A uniform thin rod is suspended by a string as shown in the given figure. Derive the differential equation of motion of the system for arbitrary large angles.



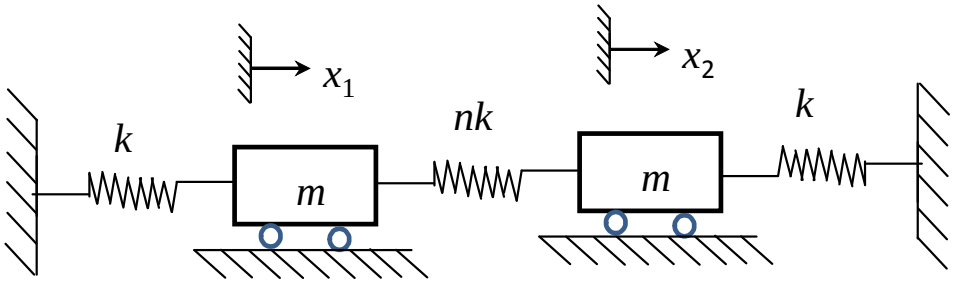
12M

UNIT–III

5. Explain Eigen values briefly. 12M

OR

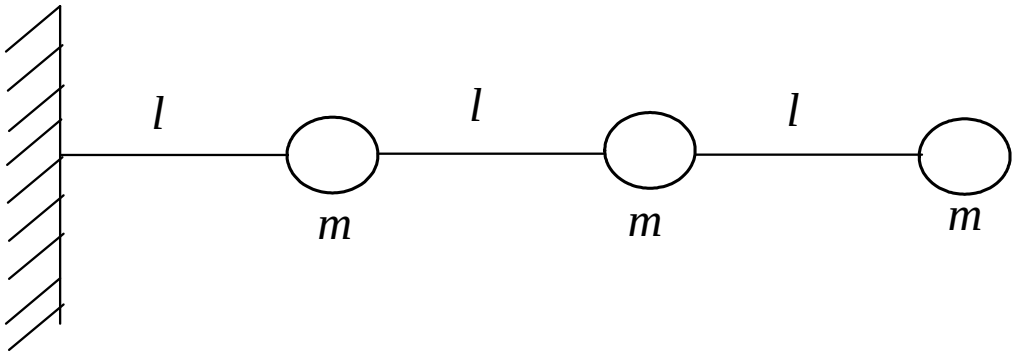
6. Determine the normal modes and frequencies of the system shown in the figure when n=1.



12M

UNIT–IV

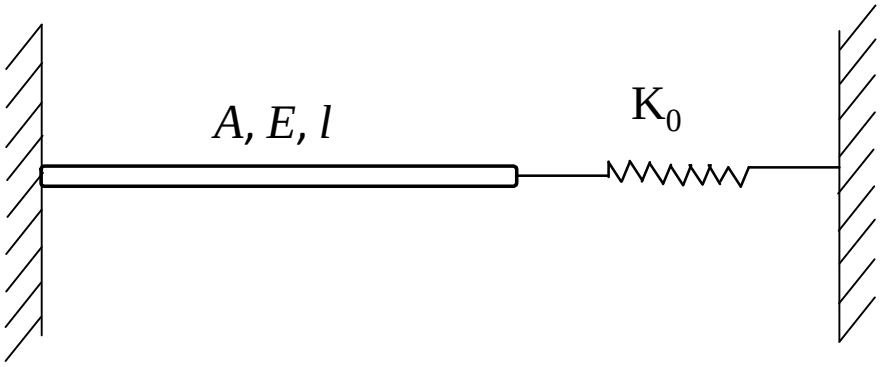
7. Using matrix iteration, determine the three natural frequencies and modes for the given cantilever beam.



12M

OR

8. Using the Rayleigh-Ritz method, determine the first two natural frequencies and mode shapes for the longitudinal vibration of a uniform rod with a spring of stiffness K_0 attached to the free end as shown in the figure. Use the first two normal modes of the fixed free rod in longitudinal motion.



12M

UNIT–V

9. The rotor of turbo super charger weighing 88.3 N is keyed to the center of a 25 mm diameter steel shaft 40 cm between bearings. Determine (a) the critical speeds of the shaft (b) the amplitude vibration of the rotor at a speed of 3200 rpm if the eccentricity is 0.015 mm. 12M

OR

10. Explain briefly free vibration of strings and torsional vibration of shafts. 12M

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