Hall Ticket Number :										

R-14

Code: 4PF511

M.Tech. I Semester Regular & Supplementary Examinations January 2017

Advanced Mechanisms

(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) Derive the Gruebler's equation of mobility for planar mechanisms 6M

   b) State and explain the Bobillier's theorm related to inflection circle. 6M

OR

2. What do you mean by 'inflection circle' and explain Hartmann's method of determining the inflection circle. 12M

UNIT–II

3. Determine the polode curvatures for the coupler link (BC) of a four bar mechanism with the following dimensions:

   Fixed link (AD) = 125 mm; Input link (AB) = 62.5 mm;

   Coupler (BC) = 75 mm; Output link(CD) = 75 mm;

   Angle DAB = 60^0. 12M

OR

4. State and prove carter-hall circle theorm. 12M

UNIT–III

5. Synthesize (determine the lengths of links) a four bar mechanism to generate function y = Sin(x) in the interval $0 \leq x \leq \pi/2$. Use three point accuracy of Chebyshe's spacing. The input link rotates from 30^0 to 120^0, where as the output link rotates from 60^0 to 150^0. Assume the length of the smallest link as 100 mm. 12M

OR

6. Explain the Bloch's method of synthesizing a four-bar mechanism. 12M

UNIT–IV

7. a) Explain the properties of the 'Rotocentre Triangle', when guiding a body through three distinct points. 6M

   b) Explain the Relative – Rotocentre method (Two position) for the synthesis of four - bar mechanism. 6M

OR

8. a) Synthesize function $y = x^{1.6}$, between the limits $1 \leq x \leq 4$, by velocity-pole method. 6M

   b) Explain Overlay's method of synthesizing a four - bar mechanism for function generation. 6M

UNIT–V

9. a) Explain the D-H parameters of a prismatic – revolute planar arm 6M

   b) Sketch and explain SCARA industrial robot manipulator. 6M

OR

10. Obtain the Transformation Matrix for the end point of a 3-DOF Articulated arm. 12M

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Hall Ticket Number :										

R14

Code: 4PF512

M.Tech. I Semester Regular & Supplementary Examinations January 2017

Advanced Mechanics of Solids

(Machine Design)

Max. Marks: 60 Time: 3 Hours

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

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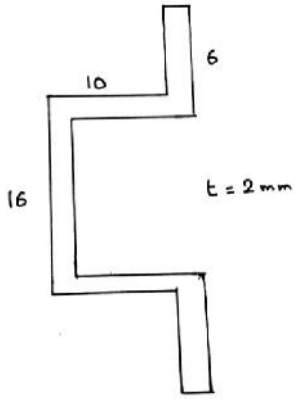
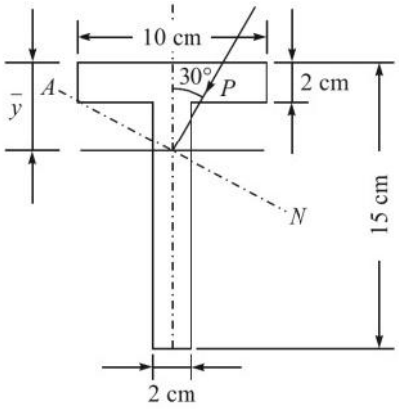
UNIT–I

1. Locate the shear center for the section shown in figure.



OR

2. A simply supported beam of T section 2.5m long carries a central compressive load inclined at 30^0 to Y-axis as shown in figure. If the maximum compressive and tensile stress in bending are not to exceed 75Mp_a and 35 Mp_a respectively. Find the maximum load that the bema can carry.



UNIT–II

3. A hook of circular section 25mm diameter and radius of curvature of its central axis is 25mm carries a load of 5kN. Calculate the maximum stress in the hook.

OR

4. What are the assumptions made in deriving the Winkler Bach formula for curved beams? Derive an expression for stress distributed in case of large initial curvature.

UNIT–III

5. In the absence of body forces, show that the following stresses satisfy the plane strain stresses formulation relations.

$$\sigma_x = kxy, \quad \sigma_y = kx, \quad \sigma_z = \nu kx(1+y)$$

$$\tau_{xy} = -\frac{1}{2}ky^2, \quad \tau_{xz} = \tau_{yz} = 0, \quad k = \text{constant}$$

OR

6. Using the polar strain-displacement relations, derive the strain-compatibility relation.

$$\frac{\partial}{\partial r}\left(2r\frac{\partial e_{r\theta}}{\partial \theta} - r^2\frac{\partial_{e\theta}}{\partial r}\right) + r\frac{\partial e_r}{\partial r} - \frac{\partial^2 e_r}{\partial \theta^2} = 0$$

UNIT–IV

7. Derive the expression for stretching of a prismatic bar when it is subjected to its self-weight.

OR

8. Derive the expression for pure bending equation of rectangular plates.

UNIT–V

9. Derive the expression for σ_r, σ_c for discs of uniform strength.

OR

10. Prove that the maximum circumferential stress in rotating discs with a central pine hole is twice the value for a solid disc of the same dimension.

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Hall Ticket Number :										

R14

Code: 4PEC14

M.Tech. I Semester Regular & Supplementary Examinations January 2017

Computational Methods

(Common to Machine Design & Structural Engineering)

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. The system of equations $x^2y+y^2=10$; $xy^2+x^2=3$ has a solution near x=0.8 and y=2.2. Perform two iterations by Newton's method to obtain the root 12M

OR

2. Compute the value of $I=\int_0^1 \frac{dx}{1+x^2}$ using the trapezoidal rule with h=0.5, 0.25 and 0.125. Then obtain a better estimate using Romberg's method. 12M

UNIT–II

3. Give the boundary value problem $x^2y''+xy'-y=0,\ y(1)=1,\ y(2)=0.5$, apply the cubic spline method to determine the value of y(1.5). 12M

OR

4. Solve $\nabla^2 u=-10\left(x^2+y^2+10\right)$ over the square mesh with sides x=0, y=0, z=3, y=3 with u=0 on the boundary and mesh length 1 unit. 12M

UNIT–III

5. Given the differential equation $\frac{\partial u}{\partial t}=\frac{\partial^2 u}{\partial x^2}$ and the boundary conditions u(0)=u(5, t)=0 and $u(x,0)=25x^2-x^4$. Take h= 1 and k = ½ 12M

OR

6. Solve the equation $\frac{\partial^2 u}{\partial t^2}=\frac{\partial^2 u}{\partial x^2}$ subject to the following conditions u(0, t) =0, u(1, t) = 0, t>0 and $\frac{\partial}{\partial t}u(x,0)=0$, u(x, 0) = $\sin^3\pi x$, $0 \le x \le 1$ 12M

UNIT–IV

7. Solve the boundary value problem defined by $y^{11}-x=0$, and $y(0)=0$, $y^1(1)=-1/2$ by the Rayleigh Ritz method. 12M

OR

8. Solve the Poisson equation $\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}=k, 0 \prec x, y \le 1$ with u=0 on the boundary C of the region S. 12M

UNIT–V

9. a) Write a short notes on 2D plots in MATLAB 6M

   b) Discuss about script files in MATLAB 6M

OR

10. Write a MATLAB programme to solve simultaneous system of linear equations numerically by Gauss elimination method. 12M

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Hall Ticket Number :										

R14

Code: 4PF513

M.Tech. I Semester Regular & Supplementary Examinations January 2017

Fracture Mechanics

(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) Explain the ductile fracture with neat sketches 6M

   b) Describe time dependent crack growth and damage tolerance 6M

OR

2. a) Explain effect of material properties on fracture 6M

   b) Define fracture. Explain the fracture at elevated temperature 6M

UNIT–II

3 a) With a neat sketches explain in detail different types loading modes 5M

   b) Explain Griffith energy balance in fracture mechanics 7M

OR

4. A plate of maraging steel has a tensile strength of 2000 MPa. Calculate the reduction in strength caused by a crack in this plate with a length 2*a* = 3.1 mm oriented normal to the tensile direction. Given: Young's modulus *E* = 210 GPa surface tension ge = 2.1 J/m2 , plastic energy per unit crack surface area gp = 2.1×10^4 J/m^2. Critical stress intensity factor *K*c = sc pa 12M

UNIT–III

5. a) Explain briefly crack tip opening displacement 6M

   b) Show that the occurrence of plastic constraint in actual structural parts leads to more safety when using the COD design curve. 6M

OR

6. a) Plot how the critical stress intensity *K*c depends on the thickness and explain this 6M

   b) A steel plate with a through thickness crack of length 2a = 22mm is subjected to a stress of 400 Mpa normal to the crack. If the yield strength of the steel is 1550Mpa, what is the plastic zone size and the stress intensity factor for the crack. Assume that the plate is infinitely wide. 6M

UNIT–IV

7. a) Explain the different stages of fatigue crack initiation and propagation 6M

   b) Explain limitations of fracture mechanics under fatigue loading 6M

OR

8. a) Explain S-N curves 6M

   b) A long, 50 mm diameter rod is manufactured from a material of 600 MPa yield and 42 MPa√m toughness. The rod is circumferentially cracked, while tensioned by a force, P. What is the maximum safe load if the crack depth is 2 mm? If the load is 220 kN, what crack depth is tolerable? 6M

UNIT–V

9. a) Explain creep curve 6M

   b) Write short note on Stress rupture test 6M

OR

10. a) Write a short notes on creep deformation maps. 6M

    b) Larson –Miller parameters 6M

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Hall Ticket Number :										

R14

Code: 4PF514

M.Tech. I Semester Regular & Supplementary Examinations January 2017

Materials Technology

(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) Explain grain boundary strengthening with suitable diagram 6M
   b) Interpret the mechanism of plastic deformation of crystals 6M

OR

2. a) How do you quantify of work hardening? Explain it with the help of Burgers vector. 6M
   b) Compare Elasticity in metals and polymers 6M

UNIT–II

3. a) Formulate strain and strain rate on plastic behavior of UT specimen 6M
   b) Differentiate between deformation of crystalline and non crystalline materials. 6M

OR

4. a) Define the following mechanical properties with reference appropriate graphs:-strength, toughness, fatigue and creep. 6M
   b) Explain the selection process of material for a typical bearing 6M

UNIT–III

5. a) Abbreviate HSLA Steel and summarize its mechanical properties. 6M
   b) When are Ni and Ti aluminides are preferred? 6M

OR

6. a) Elaborate the classification of Steels. 6M
   b) What are the advantageous and applications of TRIP steel? 6M

UNIT–IV

7. a) What are shape memory alloys and what are they used for? 6M
   b) What are the purpose the following materials:-
      (i) Dielectric elastomers (ii) Piezoelectric 6M

OR

8. a) Examine properties and applications of engineering polymers. 6M
   b) Give at least three examples to following adhesives:--
      (i) Natural adhesive (ii) Synthetic adhesives

UNIT–V

9. a) What are industrial applications of ceramics? Summarize it. 6M
   b) Prioritize SiC based ceramics over Si3 N4 ceramics. 6M

OR

10. a) Outline Composites based on the metal matrix. 6M
    b) Describe the purpose of mechanics of composite materials 6M

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Hall Ticket Number :										

R14

Code: 4PF515

M.Tech. I Semester Regular & Supplementary Examinations January 2017

Tribology

(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. Explain the terms Topography of surfaces and its properties measurement.

OR

2. Discuss the theory of sliding friction and rolling friction.

UNIT–II

3. What are the types of wear? Explain with neat sketches.

OR

4. Discuss the terms surface treatment and surface modifications.

UNIT–III

5. Explain the regimes of lubrication with a neat sketch.

OR

6. Discuss the types of lubricants and their physical properties.

UNIT–IV

7. Derive an expression for two dimensional Reynolds equation and its assumptions.

OR

8. Derive an expression for load capacity and friction calculations in Hydrodynamic bearing.

UNIT–V

9. Derive Reynolds equation elasto hydrodynamic lubrication.

OR

10. Explain the Rolling contacts of elastic solids and contact stresses.

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