Seat No.: _____   Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY
B. E. - SEMESTER –I • EXAMINATION – WINTER 2012

Subject code: 110010   **Date: 17-01-2013**

Subject Name: Mechanics of Solids

Time: 10.30 am – 01.30 pm   **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	Fill in the blanks	**07**
		(i) The process of finding components of a single force is called_____	
		(ii) Force can be defined in terms of magnitude, direction and _____	
		(iii)Two equal unlike parallel forces form a _____	
		(iv)All joints in truss are _____joints	
		(v) Radius of gyration is given by the equation k=_____	
		(vi)Value of shear stresses on principal plane is _____	
		(vii)At neutral axis, the value of bending stress in the beam is _____	
	(b)	Define :(i) Particle (ii) Equilibrant (iii) Perfect truss (iv) Bulk modulus (v) Poisson's ratio (vi) Point of contraflexure (vii) Deformable body	**07**
Q.2	**(a)**	(i) Determine magnitude and direction of resultant force of force system shown in Fig. 1	**04**
		(ii) Replace the given force system in to force couple system at A. Refer Fig. 2	**03**
	(b)	For system shown in Fig. 3 if a cylinder A weight 20 kN find weight of B and force in each cord so that the system remain in equilibrium.	**07**
Q.3	**(a)**	Calculate the force 'P' required for equilibrium of bar shown in Fig. 4 Determine total change in length of the bar. E_s= 200 GPa, E_b=100GPa, E_a=75 GPa	**07**
	(b)	Copper rod of 35 mm diameter is enclosed in steel tube of 50 mm external diameter and 44 mm internal diameter. Each is 350mm long and the assembly is rigidly held between two stops 350 mm apart. The temperature of the assembly is then raised by 150°C. Determine stresses in the tube and the rod. Find also change in length. Take α_c= 17x10⁻⁶/°C, α_s= 10.8x10⁻⁶/°C, E_c=100 GPa ,E_s= 200 GPa	**07**
Q.4	**(a)**	Determine the centroid of bar bent into a shape as shown in Fig.5	**07**
	(b)	Write assumption made in analysis of truss. Find support reaction and member forces for the truss shown in Fig 6.	**07**
Q.5	**(a)**	For beam shown in Fig7. Determine support reaction at A and B.	**07**
	(b)	Draw shear force and bending moment diagram for beam shown in Fig.8	**07**
Q.6	**(a)**	A ladder 7 m long rests against a vertical wall with which it makes an angle of 45° and resting on a floor. If a man whose weight is one half of that the ladder, climbs it. At what distance along the ladder will he be when ladder is about to slip? μ= 1/3 at wall and 1/2 at floor	**07**
	(b)	Define principal planes. The shear and normal stresses on a cross section of a beam as shown in Fig.9. Find the principal stresses and direction of principal planes	**07**
Q.7	**(a)**	A cast iron test beam 30 mm square in cross section 500 mm long is simply supported at ends. It fails at central point load at 4.32 kN. What load at free end will cause the failure of cantilever beam of 1m span made of same material 30 mmx60 mm in cross section?	**07**
	(b)	(i) Draw shear stress distribution diagrams for following shapes Rectangle, Triangle, I, H	**04**
		(ii) What do you understand by polar moment of inertia? Give the equations for moment of inertia about the base of following 1. Rectangular area 2. Triangular area	**03**

1

Q: 2 (a) (i) Fig.1

200 mm
Q: 2 (a) (ii) Fig.2

Q: 2 (b) Fig. 3

1600 mm²
Q: 3 (a) Fig. 4

Q: 4 (a) Fig 5

Q: 4 (b) Fig 6

Q: 5 (a) Fig 7

Q: 5 (b) Fig 8

Q: 6 (b) Fig. 9

2