Seat No.: _____ *Enrolment No._____*

GUJARAT TECHNOLOGICAL UNIVERSITY

B.E. Sem-I Remedial examination March 2009

Subject code: 110010

Subject Name: Mechanics of Solids

Date: 17 / 03 /2009 **Time: 10:30am To 1:00pm**

Instructions: **Total Marks: 70**

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

Q.1	(a)	Enlist and describe in brief fundamental principles and laws of mechanics.	**04**
	(b)	Define force and explain various force systems with illustrations.	**03**
	(c)	A stepped bar is loaded as shown in **Fig.1**. Calculate the stresses in each part and total change in the length of the bar. Take E_{steel}= 200 GPa, E_{copper}=100 GPa and E_{brass}=80 GPa.	**07**
Q.2	(a)	Explain in brief following mechanical properties of the material: Hardness, Toughness, Ductility, Brittleness, malleability.	**05**
	(b)	Explain the law of a machine with graphical representation.	**02**
	(c)	In a machine, it was found that the effort had to be moved through a distance of 350mm to lift the load by 7mm. Using this machine a load of 48000 N was raised by an effort of 1200 N. Determine (i) The velocity ratio of machine (ii) Mechanical Advantage (iii) Efficiency (iv) Effort in ideal condition (v) Effort lost in friction (vi) Load can be lifted with 1200N effort under ideal condition. (vii) Friction of the machine.	**07**
		OR	
	(c)	A 8m long ladder rests against a vertical wall with which it makes an angle of 45°. If a man whose weight is one half of that ladder, climbs it. At what distance along the ladder will be the man when the ladder is about to slip? The coefficient of friction μ = 0.3 between ladder & wall and 0.5 between ladder & floor.	**07**
Q.3	(a)	Explain resultant force and equilibrant force.	**02**
	(b)	Find magnitude and direction of resultant for a concurrent force system shown in **Fig.2**.	**06**
	(c)	Determine the reactions at support A and B for the beam loaded as shown in **Fig.3.**	**06**
		OR	
Q.3	(a)	Write characteristics of a couple.	**02**
	(b)	For a coplanar, non-concurrent force system shown in **Fig.4**, determine magnitude, direction and position with reference to point A of resultant force.	**06**
	(c)	Compute the member forces of the truss shown in **Fig.5** using joint method or section method.	**06**
Q.4	(a)	Explain the principal planes and principal stresses.	**02**
	(b)	Derive the equation of normal, tangential and resultant stress on an inclined plane when body is subjected to direct stresses in two mutually perpendicular directions.	**05**

(c) A steel rod 25mm in diameter is inserted inside a brass tube of 25mm internal diameter and 35mm external diameter, the ends are rigidly connected together. The assembly is heated by 30° . Find value and nature of stress developed in both the materials. Take, E_{steel}=200GPa, E_{brass}=80GPa, α_{steel} =12 x 10^{-6} per °C, α_{brass} =18 x 10^{-6} per °C . **07**

OR

Q.4 (a) Determine the location of centroid, I_{XX} and I_{YY} of lamina shown in **Fig.6.** **07**

(b) Explain tension test on mild steel bar in detail. **04**

(c) Draw a typical stress-strain curve obtained after tension test on mild steel and indicate all important point on the curve. **03**

Q.5 (a) Explain the sign convention taken to compute shear force (SF) and bending moment (BM). **02**

(b) Derive the relation between SF and BM in a beam subjected to general loading. **04**

(c) Compute SF & BM at critical points and plot SF &BM diagram for a beam shown in **Fig.7**. **08**

OR

Q.5 (a) Write assumption in the theory of pure bending and derive the equation of bending stress distribution across the cross section in a beam subjected to general loading. **05**

(b) Draw qualitative sketches of shear stress distribution across the cross section indicating position of maximum shear stress in solid circular, triangular, I-section and rhombus section. **04**

(c) A simply supported beam of span 10m, having rectangular cross-section 150mm wide x 300mm deep subjected to uniformly distributed load of 20 kN/m. Compute the values maximum shear stress and bending stress produced in the beam. **05**

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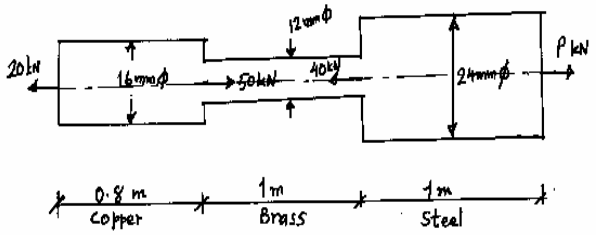

Fig.1

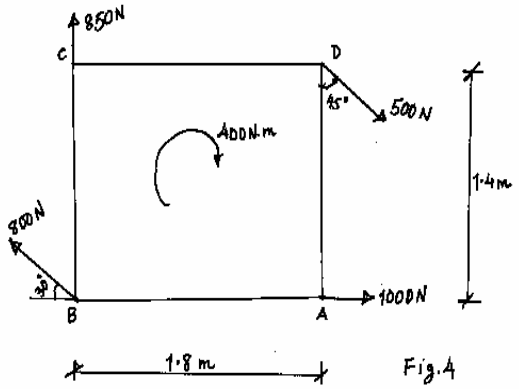

Fig.4

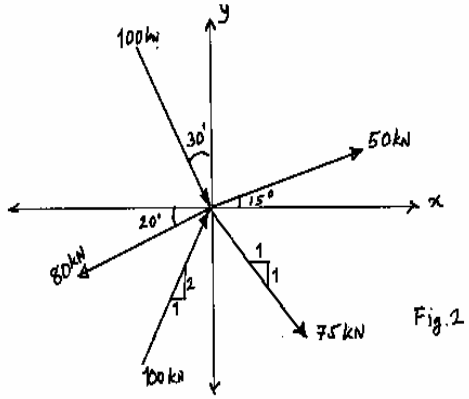

Fig.2

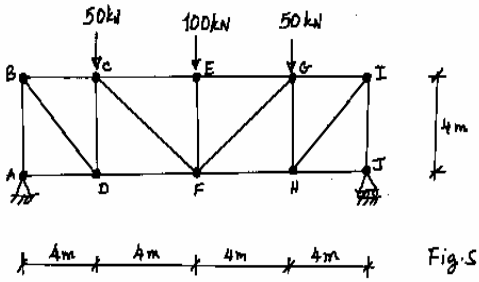

Fig.5

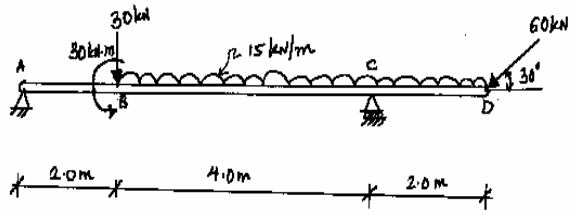

Fig.3

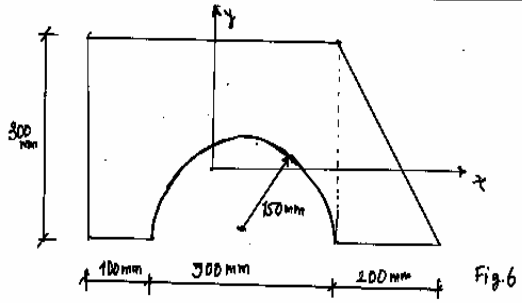

Fig.6

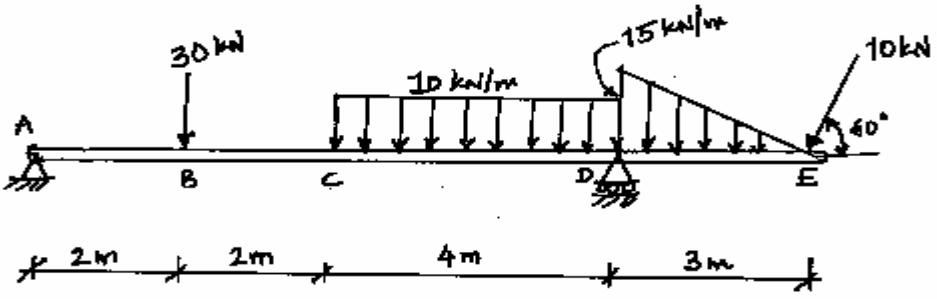

Fig.7

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