53853 Seat No._____

First Year B. Sc. (Fire) Examination

April / May – 2003

Applied Mechanics & Strength of Materials

Time : Hours] [Total Marks :

Instructions:

1. All five questions are compulsory.
2. Figures to the right indicate full marks of the questions.
3. Use of Non-programmable Scientific calculator is permitted.
4. Assume suitable additional data that may be necessary.

Q: 1 [A] State and prove '*Parallelogram Law of Forces*'. **(06)**

[B] A force system is given in Fig. 1. Determine magnitude, direction and position of the resultant force with respect to point 'A'. **(08)**

OR

Q: 1 [A] Define the term '*Mechanics*'. Give detailed distribution of Mechanics. **(03)**

[B] State and prove Varignon's Principle of Moments. **(05)**

[C] A force system is given in Fig. 2. Determine magnitude and direction of the resultant force with respect to 45 N force. **(06)**

Q: 2 [A] Define: 1. Couple, 2. Arm of Couple, 3. Moment of Couple. **(03)**

[B] Enlist characteristics of a couple. **(04)**

[C] A continuous cord is supported and loaded as shown in Fig. 3. Find the value of 'W' so that portion 'CD' remains horizontal. **(07)**

OR

Q: 2 [A] State and prove "*Lami's Theorem*". **(06)**

[B] Find the centroid of the bent wire as shown in Fig. 4. **(08)**

Q: 3 [A] Find the volume of the body generated by rotating the area about horizontal axis shown in Fig. 5, using Pappus – Guldinus Theorem. **(06)**

[B] Find Moment of Inertia of composite section as shown in Fig. 6 about its centroidal X axis. **(08)**

OR

Q: 3 [A] Find the reactions on the beam as shown in Fig. 7. Now, if the self weight of the beam is taken into consideration, the reaction at support 'A' becomes zero. What should be the self weight of the beam per meter run? **(08)**

[B] A six meter ladder weighing 20 kg is placed against a rough wall (μ_1=0.12) and rough floor (μ_2=0.2) as shown in Fig. 8. A person weighing 60 kg starts climbing ladder. Determine distance 'x' of the person from the wall when ladder just starts to slip. **(06)**

Q: 4 [A] Define: 1. Stress, 2. Strain, 3. Young's Modulus **(03)**

[B] A steel wire, 20 mm in diameter and 2.5 m long, is subjected to an axial pull of 125 kN. Determine stress, strain and modulus of elasticity if it elongates by 5 mm. **(03)**

[C] A steel bar ABCD is shown in Fig. 9. Determine stresses in different parts and total elongation. Take $E = 2 \times 10^5$ N/mm^2. **(08)**

OR

Q: 4 [A] Derive an equation for the extension of a uniformly tapering circular bar section, when it carries an axial pull P **(06)**

[B] A steel bar ABC is supported rigidly as shown in Fig. 10. If temperature is raised by 40 °C, what will be the stress in both the parts of bar. Take $E = 2 \times 10^5$ N/mm^2 and $\alpha = 12 \times 10^{-6}$ per °C. **(08)**

Q: 5 [A] Derive equations of Moment of Resistance for: **(06)**
(i) Rectangular Section, (ii) Circular Section.

[B] Draw Shear force and Bending moment diagrams for the cantilever beam as shown in Fig. 11. **(08)**

OR

Q: 5 [A] Enlist assumptions made in the theory of pure bending. **(06)**

[B] Draw Shear force and Bending moment diagrams for the overhang beam as shown in Fig. 12. Also, locate point of contraflexure. **(08)**

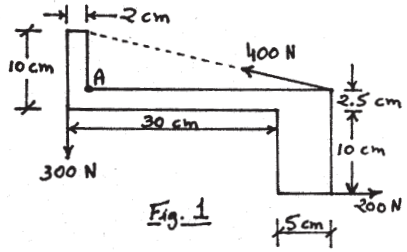

Fig. 1

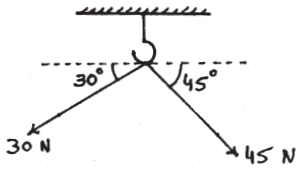

Fig. 2

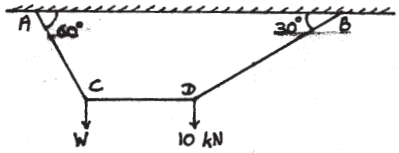

Fig. 3

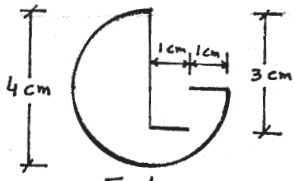

Fig. 4

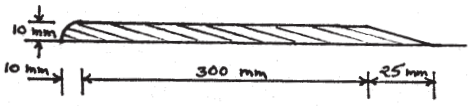

Fig. 5

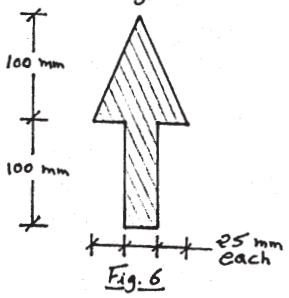

Fig. 6

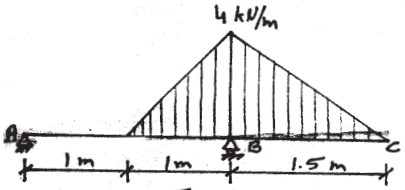

Fig. 7

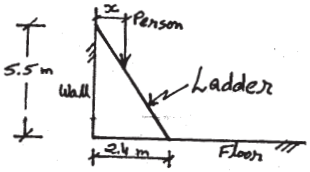

Fig. 8

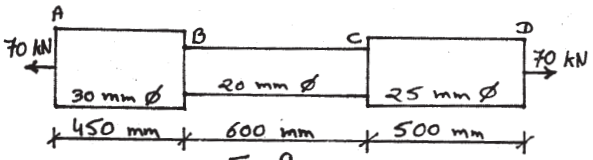

Fig. 9

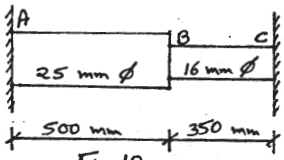

Fig. 10

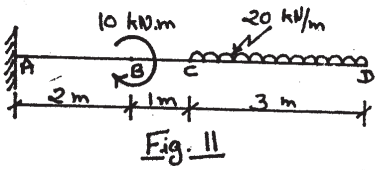

Fig. 11

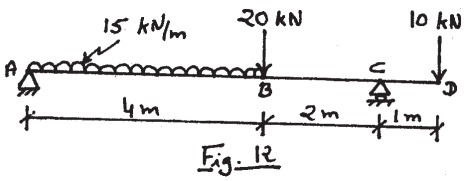

Fig. 12