



c09-c-106

**3016**

**BOARD DIPLOMA EXAMINATION, (C-09)**

**OCT/NOV—2015**

**DCE—FIRST YEAR EXAMINATION**

**ENGINEERING MECHANICS**

*Time* : 3 hours ]

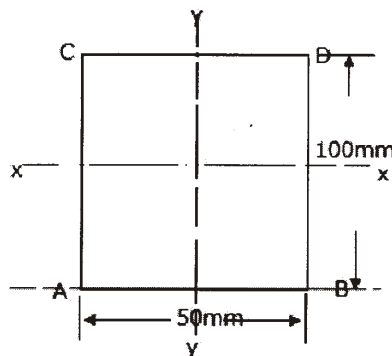
[ *Total Marks* : 80

**PART—A**

3×10=30

- Instructions** :
- (1) Answer **all** questions.
  - (2) Each question carries **three** marks.
  - (3) Answers should be brief and straight to the point and shall not exceed *five* simple sentences.

1. Define (a) equilibrium, (b) resultant and (c) equilibrant.
2. List any three properties of a couple.
3. State the formula for  $\bar{x}$  and  $\bar{y}$  for any section, i.e., centroid.
4. Find the moment of inertia of a rectangle 50 mm wide and 100 mm deep about its base :



- \* 5. Define the following terms :
- (a) Hooks' law
  - (b) Factor of safety
6. Define (a) proof resilience and (b) modulus of resilience.
7. Define the following terms :
- (a) Young's modulus
  - (b) Bulk modulus
  - (c) Modulus of rigidity
8. Define the following terms :
- (a) Shear force
  - (b) Bending moment
9. A simply supported beam of span 6 m carries a UDL of 10 kN/m over its entire length. Draw the SF diagram.
10. A simply supported beam of  $L$  meters long carries a point load  $W$  at a distance of  $a$  from the left-hand side, and  $b$  from right-hand side. Draw the sketch and write the equations for reactions.

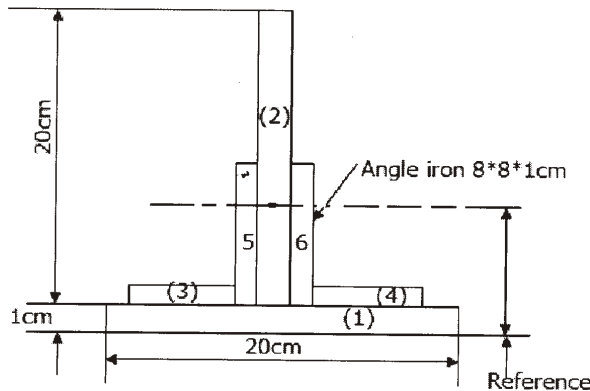
**PART—B**

10×5=50

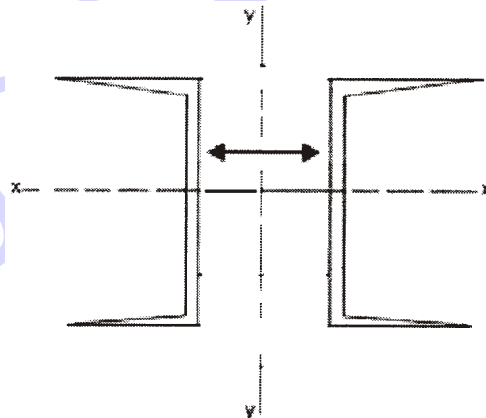
- Instructions :** (1) Answer *any five* questions.  
 (2) Each question carries **ten** marks.  
 (3) Answers should be comprehensive and the criterion for valuation is the content but not the length of the answer.

- \* 11. (a) Define the following terms :
- (i) Force
  - (ii) Resultant
  - (iii) Equilibrant
- (b) The magnitude of two forces is such that when acting at right angles produce a resultant of force of 10 N and when acting at  $60^\circ$  produce a resultant equal 13 N. Calculate the magnitude of the two forces.

- \* **12.** A built-up section is made up of plates as shown in the figure below. Find the centroid of the section with reference to base :



- 13.** A section is built-up of two 225 mm  $\times$  85 mm channels packed back-to-back at a distance of  $x$  mm apart as shown in the figure below which are connected by battens. Determine the value of  $x$  so that  $I_{xx}$  of the built-up section is equal to  $I_{yy}$  of built-up section. The properties of each channel section are  $A = 3301 \text{ mm}^2$ ;  $C_{yy} = 23 \text{ mm}$ ;  $I_{xx} = 2694.6 \times 10^6 \text{ mm}^4$ ;  $I_{yy} = 187.2 \times 10^6 \text{ mm}^4$  :

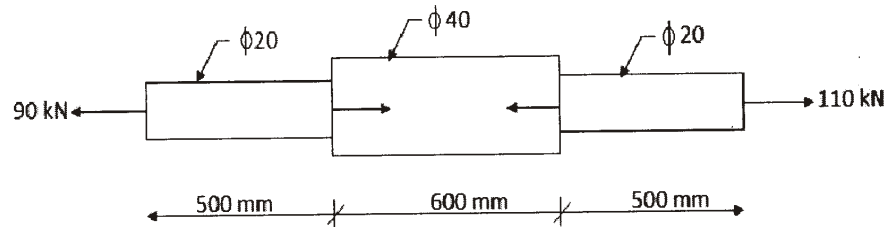


- \* **14.** A steel bar 50 mm diameter is completely encased in a brass tube of 80 mm outside diameter. The length of the composite bar is 400 mm. If this assembly is subjected to a compressive force of 80 kN. Determine—

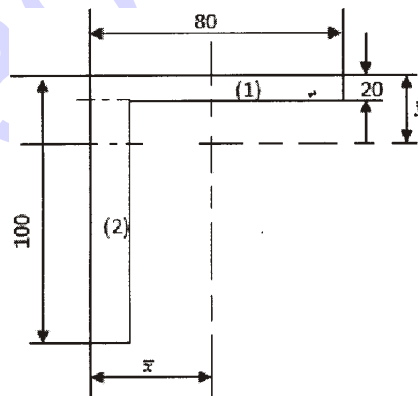
- (a) stresses in steel bar and brass tube;  
 (b) change in length of the assembly.

Given  $E$  for steel =  $208 \text{ kN/mm}^2$  and  $E$  for brass =  $104 \text{ kN/mm}^2$ . Also find the load shared by each material.

- \* 15. A steel bar 1.6 m long is acted upon by forces as shown in the figure below. Find the elongation of the bar. Given  $E = 200 \text{ GPa}$  :



16. Draw the sketch of a symmetrically loaded over hanging beam with a concentrated load at the centre.
17. A simply supported beam of 6 m long carries a UDL of  $6 \text{ kN/m}$  over a length of 2 m, 3 m away from the left-hand support A, towards right. Also it carries a point load of 10 kN at 1 m from left-hand support. Draw the SF and BM diagrams. Indicate the position and magnitude of maximum BM.
18. (a) Determine the centroid of the lamina shown in the figure below :



- (b) A hollow circular shaft of internal diameter equal to 0.8 times external diameter has polar moment of inertia equal to that of a solid circular shaft of diameter 160 mm. Find the external and internal diameters of a hollow circular shaft.

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