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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

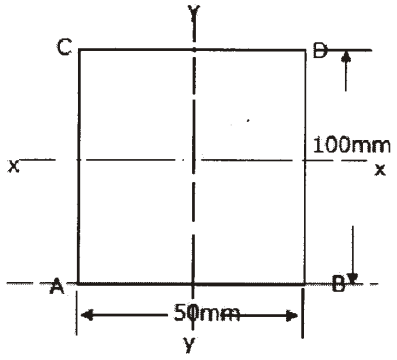
Instructions : (1) Answer **all** questions.
(2) Each question carries **three** marks.
(3) Answers should be brief and straight to the point and shall not exceed *five* simple sentences.

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 :

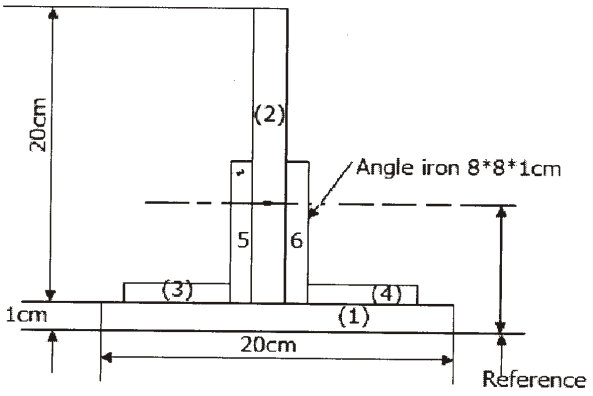
(i) Force

(ii) Resultant

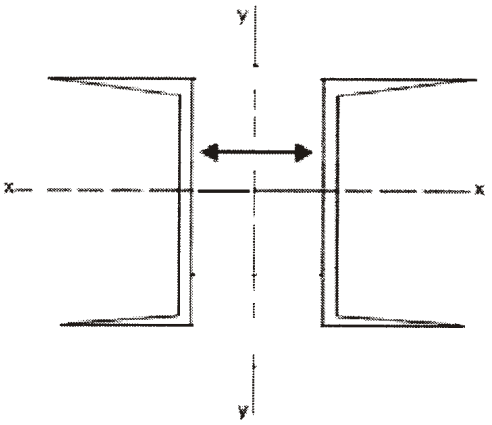
(iii) Equilibrant

(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° 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 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 mm^2; C_{yy} 23 mm; I_{xx} 2694 6 10^6 mm^4; I_{yy} 187 2 10^6 mm^4 :



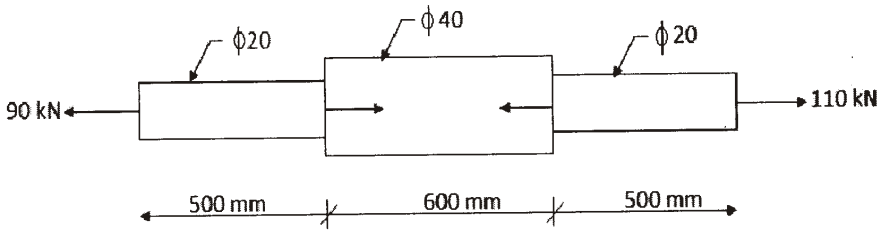
14. A steel bar 50 mm diameter is completely encased in a brass tube of 80 m outside diameter. The length of the composite bar is 400 mm. If this assembly is subjected to a compressive force of 80 kN. Determine—

(a) stresses in steel bar and brass tube;

(b) change in length of the assembly.

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

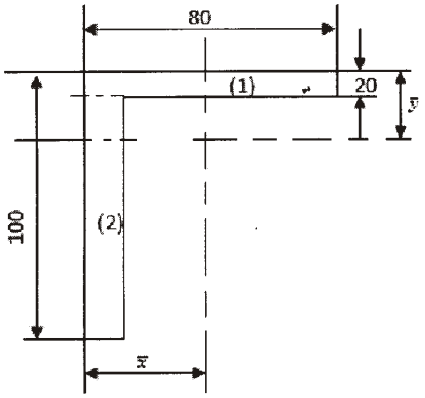
15. A steel bar 1·6 m long is acted upon by forces as shown in the figure below. Find the elongation of the bar. Given E 200 GPa :



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 6kN/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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