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C14–C–105

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BOARD DIPLOMA EXAMINATION, (C–14)

MARCH/APRIL—2016

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. State any three fundamental quantities and give their units in SI system. 3

2. Find the support reactions for a simply supported beam of span l (a b) meters and is loaded with a point load of WN placed at a distance of a meters from the left support. 1½+1½

3. Two forces 20 kN and 30 kN act at right angles. Determine the magnitude and direction of resultant force.

4. Define the terms centroid and centre of gravity. 1½+1½

5. A masonry dam is trapezoidal in section with one face vertical. The top width is 4 m, bottom width is 10 m and height 12 m. Find the position of centroid from base.

6. Find the moment of inertia of the hollow rectangular section of outer dimensions 180 mm × 120 mm and inner dimensions 140 mm × 80 mm about its base.

7. Determine the radius of gyration of a hollow circular section of external diameter 100 mm and thickness 10 mm.

8. Define the terms *(a)* strain, *(b)* longitudinal strain and *(c)* strain energy.

9. Draw the stress strain curve for a ductile material and mention the salient points.

10. Define the terms *(a)* ductility, *(b)* brittleness and *(c)* Poisson's ratio.

PART—B 10×5=50

Instructions : (1) Answer any **five** questions.

(2) Each question carries **ten** marks.

(3) Answers should be comprehensive and the criteria for valuation are the content but not the length of the answer.

11. Four forces acting at a point are in equilibrium. Three of them are 400 N, 500 N and 200 N making 45°, 90° and 270° with +ve side of *x*-axis in the anti-clockwise direction. Calculate the magnitude and direction of the fourth force.

12. *(a)* State Lami's theorem.

(b) A body of weight 1000 N is suspended by two strings of 4 m and 3 m lengths attached at the same horizontal level 5 m apart. Calculate the forces in the strings.

13. Locate the position of centre of gravity of an I section with the following dimensions from its top :

Top flange	200 mm	20 mm
Bottom flange	300 mm	10 mm
Web	400 mm	10 mm

14. A built-up section is made up of two ISHB 450 mm × 250 mm RSJs placed at 300 mm centre to centre distance and a flat plate of size 600 mm × 20 mm connected one at top and another at bottom of the flanges, so that a box section is formed. Find I_{xx} and I_{yy} of the built-up section :

For each RSJ,

Area 11789 mm^2

I_{xx} 40350 $10^4 mm^4$

I_{yy} 3045 $10^4 mm^4$

15. *(a)* State *(i)* parallel axis theorem and *(ii)* perpendicular axis theorem.

(b) For a square lamina of sides 12 mm, calculate the moment of inertia about an axis parallel to base and at a distance of 10 mm above the base.

16. Two bars *A* and *B* made up of same material and same length 1·2 m are subjected to the same axial load. The area of cross-section of bar *A* is 600 mm^2 for a part of its length and 900 mm^2 for the remaining length. The bar *B* is having an area of cross-section 300 mm^2 for its entire length. If the elongation of bar *A* is 42% of the elongation of bar *B*, what length of bar *A* is of 600 mm^2 area?

17. A copper rod 30 mm diameter is enclosed within a steel tube of 35 mm internal diameter and 40 mm external diameter. The ends of the rod and the tube are rigidly connected together. If the composite section is heated through 80 °C, what stress will develop in each? Given :

$_s$ 6 10^{-6}/ C E_s 200 GPa

$_c$ 10 10^{-6}/ C E_c 120 GPa

18. A load of 50 kN is suddenly applied on a bar 2 m long and 1000 mm^2 in cross-section. What is the maximum instantaneous stress produced? What strain energy is stored, if *E* 200 GPa?

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