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C14–C–105

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BOARD DIPLOMA EXAMINATION, (C–14)

MARCH/APRIL—2017

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 fundamental and derived quantities with examples.

2. State the parallelogram law of forces.

3. List various types of supports of a beam.

4. Distinguish between centroid and centre of gravity.

5. Locate the position of centroid of a semicircular lamina of radius 5 cm with a sketch.

6. Define the terms *(a)* polar moment of inertia and *(b)* radius of gyration.

7. Find the moment of inertia about its base of a triangular section of base 100 and height 150 mm.

8. State Hookes law and define the term Young's modulus.

9. Define the terms *(a)* modulus of rigidity and *(b)* bulk modulus.

10. A steel bar 5 meters long, 25 mm in diameter is stretched by 3 mm by a tensile load of 80 kN. Determine modulus of elasticity of the bar.

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 force and state the characteristics of force with the help of a sketch.

(b) Find the two forces having an angle 60° between their lines of actions when their resultant is 90 N. The resultant is making an angle of 30° with one of the forces.

12. Find the magnitude and direction of resultant force for the following forces acting at a point :

(a) 30 kN due North-East

(b) 40 kN at 60° East of South

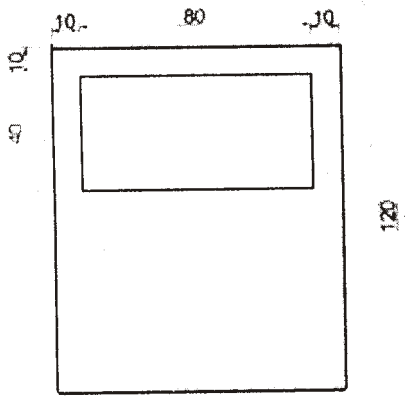
(c) 60 kN at 60° South of West

(d) 20 kN at 60° West of North

13. A masonry dam is trapezoidal in section with one face vertical. Top width is 3 m, bottom width is 10 m and height is 10 m. Find the position of centroid.

14. Determine the position of centroid and calculate the moment of inertia about its horizontal centroidal axis of a T-Section which has flange 200 mm × 50 mm and web 200 mm × 50 mm.

15. Find the moment of inertia about its horizontal and vertical centroidal axes (I_{xx} and I_{yy}) of the rectangular lamina of size 100 mm × 120 mm with a hole 80 mm × 40 mm as shown in figure :



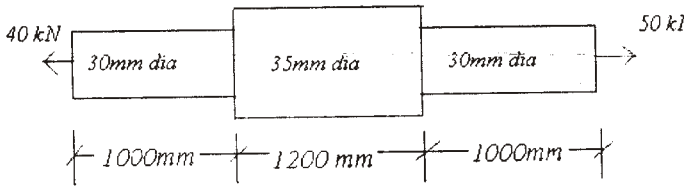
16. The following observations were made during test on a mild steel bar of 20 mm diameter :

Gauge length = 200 mm
Extension at 314 kN = 0·1 mm
Yield load = 88 kN
Ultimate load = 132 kN
Breaking load = 92 kN
Total elongation = 54 mm
Diameter of rod at failure = 14·2 mm

Calculate *(a)* Young's modulus, *(b)* ultimate stress, *(c)* yield stress, *(d)* breaking stress and *(e)* percentage elongation.

17. A reinforced concrete column 300 mm × 300 mm in section is provided with 8 bars of 20 mm in dia. The column carries an axial load of 600 kN. Find the stress in concrete and steel and also calculate the loads shared by concrete and steel, $m = 15$.

18. A steel bar of variable section is subjected to forces as shown in figure below. Taking E 205 kN/mm^2, determine the total elongation :



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