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C14–C–105

# 4019

## BOARD DIPLOMA EXAMINATION, (C–14)

## OCT/NOV—2017

## DCE—FIRST YEAR EXAMINATION

ENGINEERING MECHANICS

*Time* : 3 hours ]

**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.** Mention the various base quantities and their units in SI system.

**2.** Define the terms *(a)* force, *(b)* moment and *(c)* equilibrant.

**3.** Draw neat sketches of any three types of supports.

**4.** Define the terms 'centroid' and 'centre of gravity'.

**5.** Determine the coordinates of the centroid for an equal angle of size 100 mm × 100 mm × 10 mm.

**6.** Find the moment of inertia of a circle of radius 40 mm about any tangent to the circle.

**7.** Determine the values of the $I_{xx}$ and $I_{yy}$ of a rectangular lamina of size 200 mm × 120 mm.

**8.** Define the terms *(a)* modulus of elasticity, *(b)* modulus of rigidity and *(c)* modulus of resilience.

**9.** The modulus of rigidity of a material is 0 8 $10^5$ N/mm$^2$ and Young's modulus is 2 $10^5$ N/mm$^2$. Find its bulk modulus.

**10.** Define the terms *(a)* plasticity, *(b)* malleability and *(c)* toughness.

**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 wheel has eight spokes which are equispaced. The forces acting in six consecutive spokes are 400, 600, 800, 400, 600 and 800 N respectively. Find the forces acting in the other two spokes for the wheel to be in equilibrium.

**12.** Find the support reactions for a simply supported beam of span 10 m and is loaded with a udl of 5 kN/m in a length of 4 m from the left support. In addition it also carries a point load of 20 kN placed at 3 m from the right support.

**13.** Find the position of centroid of an I section from the base when,

| | |
|---|---|
| Top flange | = 200 mm × 40 mm |
| Web | = 40 mm × 240 mm |
| Bottom flange | = 300 mm × 70 mm |

**14.** *(a)* State *(i)* parallel axis theorem and *(ii)* perpendicular axis theorem. 4

*(b)* Find $I_{xx}$ and $I_{yy}$ for a T section having flange 100 mm × 20 mm and web 80 mm × 20 mm. 6

**15.** A built-up section is made up of one ISHB 250 mm × 450 mm and a flat plate 300 mm × 20 mm one at top and one at bottom of the flange. Determine the radius of gyration of the section about the horizontal and vertical centroidal axes :

For each RSJ,

$A$ 11789 $mm^2$

$I_{xx}$ 403 5 $10^6$ $mm^4$

$I_{yy}$ 30 45 $10^6$ $mm^4$

Flange width = 250 mm

**16.** A steel rod 20 mm in diameter, 200 mm long is heated through 100 °K and at the same time subjected to a pull $P$ kN. If the total extension of the rod is 0·3 mm, what should be the magnitude of $P$. Take for steel 12 $10^{-6}$ / K and $E$ 215 kN / $mm^2$.

**17.** A circular RC column of 300 mm dia and 4 m length is reinforced with 6 numbers of 16 mm dia bars. The permissible stress in concrete is 4 MPa. Assuming the perfect bond between concrete and steel, find out the maximum load-carrying capacity of the column. Modular ratio of the material is 18·7.

**18.** A 40 mm diameter metal bar carrying a load of 200 kN extended by 0·34 mm on a gauge length of 150 mm. The contraction in diameter was 0·022 mm. Calculate the values of the four elastic constants of the material.

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