4019

BOARD DIPLOMA EXAMINATION, (C–14)
APRIL/MAY—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 the terms *(a)* Statics, *(b)* Dynamics and *(c)* Kinematics.　　3

2. Define couple and state any two properties of a couple.　　1+2

3. Calculate the support reactions for the beam given below :　　3
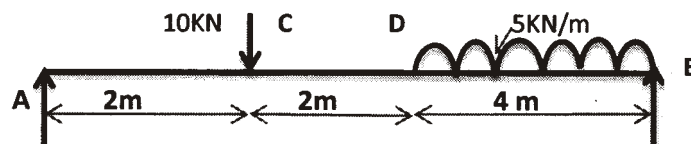
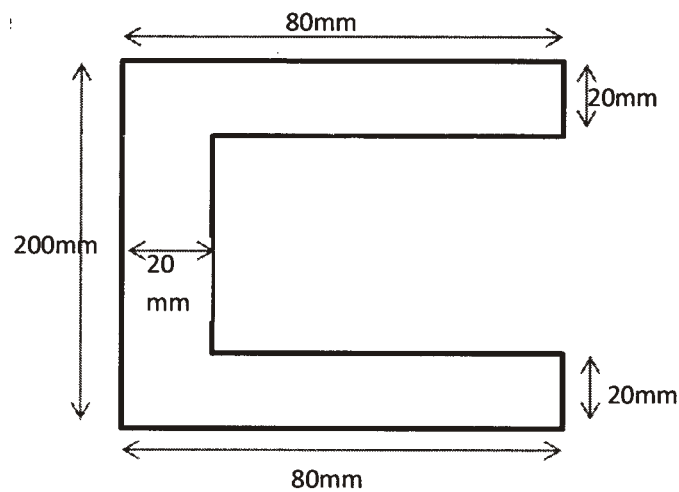**4.** Differentiate between centre of gravity and centroid.　　1½+1½

5. Find centroid of channel section given below :　　　3

6. State parallel axis theorem and perpendicular axis theorem.

$1\frac{1}{2}+1\frac{1}{2}$

7. Calculate the moment of inertia and minimum radius of gyration of a rectangular section having dimensions 300×600 mm.　　　2+1

8. Define the terms *(a)* Poisson's ratio, *(b)* Factor of safety and *(c)* Modulus of resilience.　　　3

9. A steel rod of 30 mm in diameter and 600 mm long has a permissible stress 116 N/mm^2. Calculate *(a)* the pull required in kN and *(b)* elongation in mm if $E \; 2 \; 10^5$ N / mm^2.　　$1\frac{1}{2}+1\frac{1}{2}$

10. A steel bar of length 2·5 m and 20 mm dia subjected to a pull of 65 kN. Calculate *(a)* stress in bar if load is applied suddenly and *(b)* strain energy in bar. $E \; 200$ kN / mm^2.　　$1\frac{1}{2}+1\frac{1}{2}$
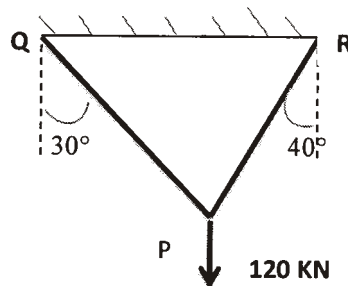
Instructions : (1) Answer any **five** questions.

(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. *(a)* State the law of polygon of forces and State Lami's theorem with neat sketch. 2+2
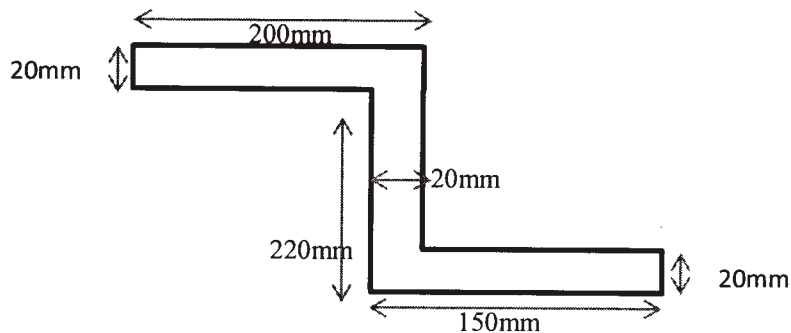
*(b)* Calculate the forces in cables PQ and PR shown in the figure below : 6

12. Four forces of magnitude 300 kN, 500 kN, 400 kN and 600 kN are acting at a point in North 30° East, Due South East, South 30° West and North 30° West. Find the magnitude and direction of resultant force. Also show resultant force in quadrant system. 10

13. Find the centroid for Z-section shown below : 10

14. *(a)* Define Polar moment of inertia of a plane area. 2

(b) Calculate moment of inertia and polar moment of inertia of the given section below : 8
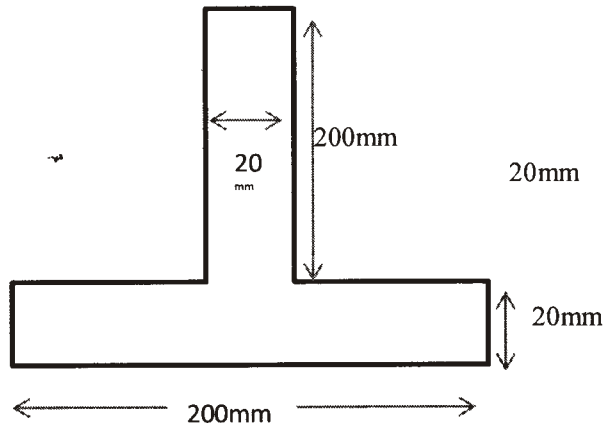
15. Find moment of inertia of an unequal angle 150 × 120 × 20 mm about centroidal axes. 4+6

16. Define the terms *(a)* stiffness, *(b)* hardness, *(c)* toughness, *(d)* creep and *(e)* fatigue with two examples. 2×5

17. A bar of 25 mm diameter and 600 mm long is subjected to a pull of 50 kN. The change in diameter and length was observed to be 4×10^{3} mm and 0·30 mm. Calculate *(a)* Young's modulus, *(b)* Possion's ratio, *(c)* Modulus of rigidity and *(d)* Factor of safety if ultimate stress = 204 N/mm^2. 2½×4

18. A composite bar 30 mm diameter and 600 mm long made of steel is enclosed in a brass tube having external diameter 60 mm and 8 mm thick. If temperature is raised to 80 °C, then calculate the stresses induced in each material.
Take $\alpha_s = 12 \times 10^{6}$ /°C, $\alpha_b = 19 \times 10^{6}$ /°C and $E_s = 200$ GPa, $m = \frac{1}{2}$ 5+5

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