* 3 0 1 6 *

C09–C–106

3016

BOARD DIPLOMA EXAMINATION, (C–09)

MARCH/APRIL—2018

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) Answer should be brief and straight to the point and shall not exceed *five* simple sentences.

1. State 'parallelogram law of forces' with a neat sketch.

2. Define couple and give an example.

3. State the formula for $\bar{x}$ and $\bar{y}$ for any section.

4. Write the practical applications of determination of moment of inertia.

5. A steel rod 50 mm in diameter is 3 m long. Find the maximum instantaneous stress produced when an axial pull of 120 kN is suddenly applied to it. Take E 20 10^5 N/mm^2.

6. The length of a rail in a railway track is 30 m at 25° C. Determine the temperature stress developed in the rail at 65° C, if there is no allowance for expansion. Take E 2 10^5 N/mm^2 and 0 000012/°C.

7. Define the following :

(a) Lateral strain

(b) Poisson's ratio

8. Draw the sketches of—

(a) continuous beam;

(b) overhanging beam;

(c) simply-supported beam.

9. State the sign conventions that are normally adopted while calculating the shear force and bending moment diagrams.

10. Draw the sketches of—

(a) roller support;

(b) hinged support;

(c) fixed support.

showing the reactions.

PART—B

10×5=50

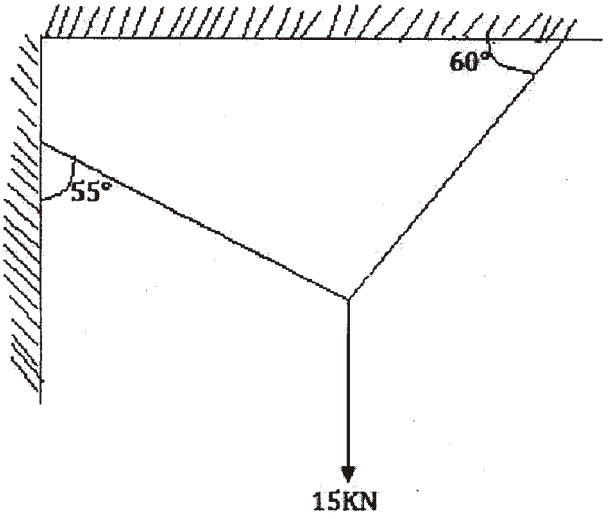
Instructions : (1) Answer *any* **five** questions.

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

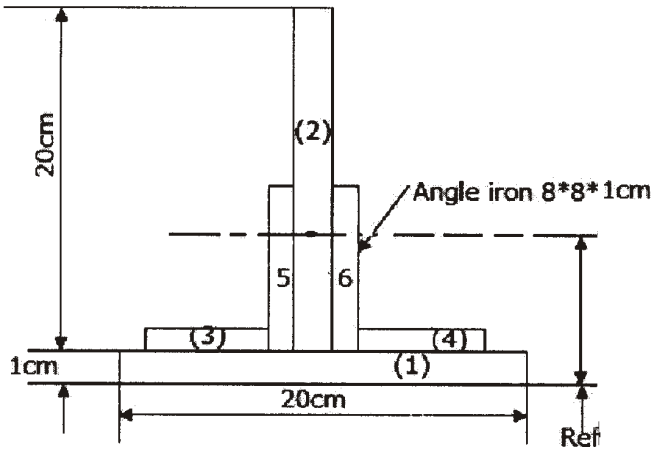
(3) Answers should be comprehensive and the criterion for valuation is the content but not the length of the answer.

11. *(a)* With the help if a sketch, state the 'triangle law of force'.

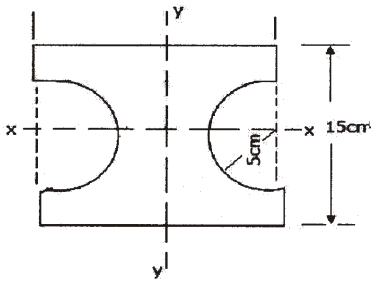
(b) An electric light fixture weighing 50 N hangs form a point *B* by two springs *AB* and *BC* as shown in fig 1. Using Lami's theorem, determine the forces in the strings *AB* and *BC* :



12. A built-up section is made up of plates as shown in fig 2. Find the centroid of the section with reference to base :



13. Determine I_{xx} and I_{yy} of the cross-section of a cast-iron beam about its centroidal axes shown in fig 3 :



14. A straight stepped bar of steel is of square section throughout with sides 10 mm, 12 mm and 16 mm with axial length 80 mm, 100 mm and 120 mm respectively. The bar is subjected to an axial force of 3·6 kN. Find the value of modulus of elasticity for the material if total change in length is found to be 0·0353 mm. Also find the stresses and strains in each portion of the bar.

15. *(a)* Differentiate the following :

(i) Ultimate stress

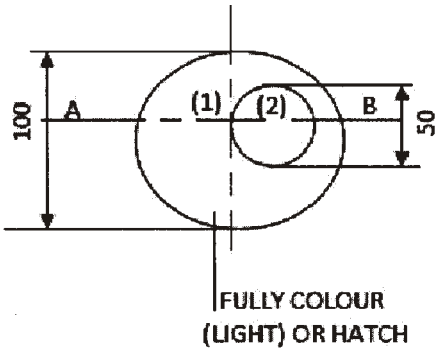
(ii) Safe stress

(b) A mild steel tube of outside diameter 114·3 mm and 4·5 mm wall thickness is subjected to an axial compression of 125 kN. Determine whether the tube is safe, if the permissible compressive stress in this tube is 110 MPa. What maximum load can be supported by the tube? If the factor of safety over compressive stress is 4, determine the crushing load.

16. A simply-supported beam with a concentrated load of 45 kN acting at the middle of the beam has a span of 6 m. Also it carries a UDL of 20 kN/m over a length of 2·5 m from right end. Draw the SF and BM diagrams.

17. A simply-supported beam of span 10 m carries a UDL of 15 kN/m up to a distance of 6 m from left end support and a concentrated load of 30 kN at a distance of 2 m from RHS. Draw the SF and BM diagrams and also find max bending moment and its position.

18. *(a)* A circular disc of 50 mm diameter is cut out from a circular disc of 100 mm diameter as shown in fig 4. Find the centroid of the section from *A*. All dimensions are in mm :



(b) A hollow shaft has an outside diameter 150 mm and inside diameter 120 mm. Determine the moment of inertia and radius of gyration about its diameter.

★ ★ ★