No. of Printed Pages : 8

BCE-032

DIPLOMA IN CIVIL ENGINEERING (DCLE (G)) / ADVANCED LEVEL CERTIFICATE COURSE IN CIVIL ENGINEERING (DCLEVI/ACCLEVI)

Term-End Examination

00457

December, 2017

BCE-032 : THEORY OF STRUCTURES – I

Time : 2 hours *Maximum Marks : 70*

Note : *Attempt any **five** questions including question number **1** which is **compulsory**. Assume suitable data, if missing and mention it clearly. Use of calculator is permitted.*

1. Choose the correct answer from the given options for q. no. 1 (a) to 1 (g) : *7×2=14*

(a) For the following beam shown in Figure 1, which of the options is correct for "maximum reaction at A" ?

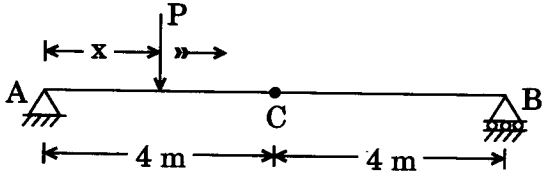


Figure 1

(i) x = 4 m

(ii) x = 8 m

(iii) x = zero

(iv) Both (i) and (ii) are correct

(b) For the propped cantilever beam shown in Figure 2, the correct BMD is

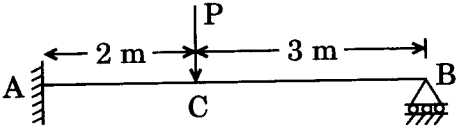
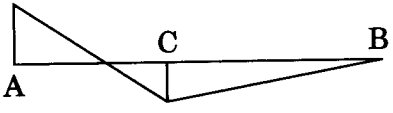
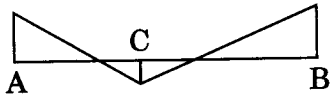


Figure 2

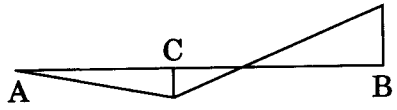
(i)



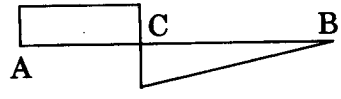
(ii)



(iii)



(iv)



(c) The absolute stiffness of a prismatic member with far end being fixed is given by (EI is constant)

(i) $\frac{3\,EI}{L}$

(ii) $\frac{3\,EI}{4\,L}$

(iii) $\frac{4\,EI}{L}$

(iv) $\frac{EI}{L}$

(d) The fixed end moments of a fixed beam AB subjected to point load 'P' at 'C' (as shown in Figure 3) is given by

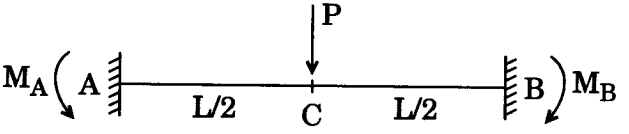


Figure 3

(i) $M_A = M_B = \frac{PL^2}{4}$

(ii) $M_A = M_B = \frac{PL}{8}$

(iii) $M_A = M_B = \frac{PL^2}{8}$

(iv) $M_A = M_B = \frac{PL}{4}$

(e) If d_n is the nominal diameter of a rivet then as per IS specification the minimum pitch of rivets, S is

(i) $S < 2{\cdot}5\ d_n$

(ii) $S \leq 2{\cdot}5\ d_n$

(iii) $S > 2{\cdot}5\ d_n$

(iv) $S \geq 2{\cdot}5\ d_n$

(f) The slenderness ratio of a column section is given by (if r is radius of gyration)

(i) $\dfrac{\text{effective length}}{r_{min}}$

(ii) $\dfrac{\text{effective length}}{r_{max}}$

(iii) $\dfrac{\text{unsupported length}}{r_{min}}$

(iv) $\dfrac{\text{unsupported length}}{r_{max}}$

(g) The slope of a roof truss is given by

(i) $\dfrac{\text{Rise}}{\text{Span}}$

(ii) $\dfrac{2 \times \text{Rise}}{\text{Span}}$

(iii) $\dfrac{\text{Rise}}{2 \times \text{Span}}$

(iv) None of the above

2. Two wheel loads of 16 kN and 8 kN at a fixed distance apart of 2 m, cross a simply supported beam of 10 m span. For this beam draw the influence line diagram for bending moment and shear force for a point 4 m from the left hand support (i.e. C) (as shown in Figure 4) *14*

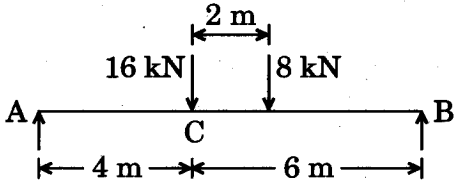


Figure 4

3. Using the moment distribution method determine the moments at A, B and C for the beam shown in Figure 5. *14*

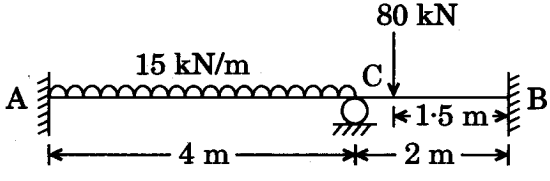


Figure 5

4. Two plates 12 mm thick are joined by double riveted double cover butt joint, using 20 mm diameter rivets (power driven shop rivets). Design the pitch of the rivets and also find the efficiency of the joint. Give a neat sketch of the joint.

Take permissible tensile stress in plate = 150 MPa, allowable bearing and shearing stress in rivet = 300 MPa and 100 MPa respectively. *14*

5. (a) Differentiate between the following : *8*

(i) Gauge distance and Staggered pitch

(ii) Nominal diameter and Gross diameter of rivets

(b) Why are hollow circular pipes preferred instead of solid circular sections to be used as compression members ? *6*

6. An angle section (ISA 70 × 70 × 10) is used as a tension member and connected to a gusset plate by 16 mm diameter rivets through both legs. The pitch of rivets on both the legs is 50 mm and are staggered by 25 mm. Find the permissible axial tension in the angle section. Give a neat sketch. *14*

Take permissible tensile stress of angle section = 150 MPa, (Refer Figure 6).

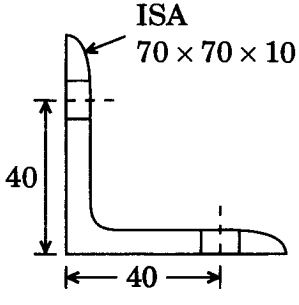


Figure 6

7. Determine the allowable axial compressive force for the double angle strut shown in Figure 7. Take f_y = 250 MPa and allowable stress in axial compression (σ_{ac}) as below : *14*

l/r	90	100	110	120
σ_{ac} (N/mm^2)	90	80	72	64

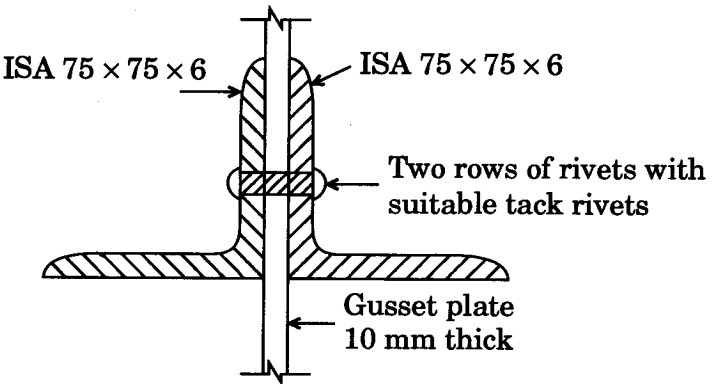


Figure 7

Consider the length of strut between intersections as 2·8 m

For ISA 75 × 75 × 6, $r_{xx} = r_{yy}$ = 2·30 cm, A = 8·66 cm^2, $c_x = c_y$ = 2·06 cm

8. (a) Discuss the stability of a retaining wall in detail with regard to sliding and overturning. *8*

(b) Give a neat labelled sketch showing plan and sectional elevation of a grillage base. *6*

9. Write short notes on any ***four*** of the following :

$4 \times 3\frac{1}{2} = 14$

(a) First Moment Area Theorem

(b) Types of Riveted Joints

(c) Advantages of Steel Construction

(d) Built Up Column with Single Lacing

(e) Laterally Supported Beams

(f) Web Crippling and Local Buckling