

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

Term-End Examination

December, 2016

BCE-032 : THEORY OF STRUCTURES – I

Time : 2 hours

Maximum Marks : 70

Note : *Question number 1 is compulsory. Attempt any four questions from the remaining. Total number of questions to be attempted are five. Assume suitable data wherever necessary and mention it clearly. Use of scientific calculator and steel tables is permitted.*

1. Choose the most appropriate answer from the following alternatives in each case : $7 \times 2 = 14$

(a) Maximum permissible pitch in the direction of the stress in a riveted joint in compression is

(i) $16 t$ or 200 mm whichever is less

(ii) $12 t$ or 200 mm whichever is less

(iii) $2.5 \times$ diameter of the rivet

(iv) $4 t + 100$

(t = thickness of plates joined)

(b) A rivet has a nominal diameter d_n , Gross diameter = d and maximum permissible shear stress = τ_{vf} . The resistance of a rivet in single shear is given by

(i) $\frac{\pi}{4} d_n^2 \tau_{vf}$

(ii) $\pi d^2 \tau_{vf}$

(iii) $\frac{\pi}{4} d^2 \tau_{vf}$

(iv) $\pi d \tau_{vf}$

(c) The effective length of a column having unsupported length 'L' and one end fixed and the other end hinged is given by

(i) 0.80 L

(ii) 0.65 L

(iii) 1.5 L

(iv) 1.2 L

(d) The efficiency of a riveted joint is equal to the ratio of

(i) Greatest strength of the joint to the strength of solid plate

(ii) Least strength of the riveted plate to the greatest strength of the joint

(iii) Least strength of the joint to the strength of solid plate

(iv) All the above

(e) The ordinate of the influence line diagram for bending moment will always have the dimensions of

- (i) Length
- (ii) Force \times Length
- (iii) Force
- (iv) $\frac{\text{Force}}{\text{Length}}$

(f) A propped cantilever has

- (i) one end fixed and the other end free
- (ii) both ends fixed
- (iii) one end hinged and the other end roller supported
- (iv) one end fixed and the other end roller supported

(g) The slope and deflection at various points in a beam subjected to Bending Moment are

- (i) Interdependent function
- (ii) Independent function
- (iii) Directly proportional to BM
- (iv) None of the above

2. Draw the influences line for BM and SF at point 'X' (Figure 1) in the simply supported beam AB of span 9 m.

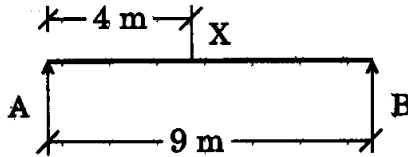


Figure 1

- (a) Calculate the maximum negative and positive SF at X when two connected wheel loads, 7 kN and 15 kN, 2 m apart, cross the beam from A to B.
- (b) Calculate the maximum BM at X when a UDL of 7 kN/m of length 3 m crosses the beam from A to B.
- 14
3. Analyse the beam as shown in Figure 2 by moment distribution method. Calculate the support moments and reactions. Flexural rigidity is shown as in circles. Draw the BM and SF diagrams.
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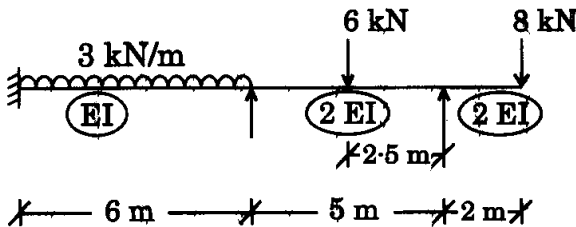


Figure 2

4. A single-riveted double-cover butt joint is used to connect two plates of 12 mm thickness (Figure 3). Power driven field rivets of 18 mm are used with cover plates of 12 mm. Calculate the necessary pitch and efficiency of the joint. Assume bearing stress of rivets = 270 N/mm^2 , shearing stress of rivets = 90 N/mm^2 and f_y for the plate = 150 N/mm^2 .

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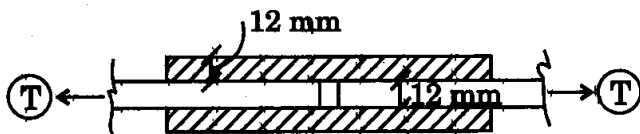
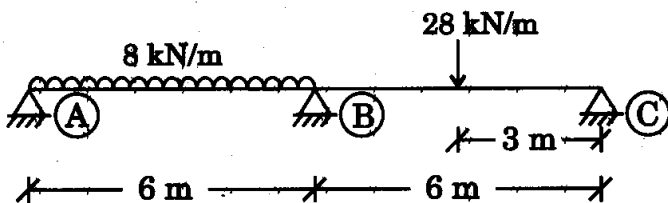


Figure 3

5. A continuous beam is loaded as shown in Figure 4. Calculate support reaction and draw B.M.D. and S.F.D. using Three Moments Theorem. Assume EI constant for the beam.

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$EI = \text{constant}$

Figure 4

6. A tension member consists of two $100 \times 75 \times 8$ mm IS angles. These angles are connected by their long legs to a gusset plate by means of 16 mm diameter rivets in such a way that each angle section is reduced by one rivet only. Calculate the tensile strength of the member

- (a) if the angles are connected on the same side of a gusset plate of 10 mm thickness and the angles are properly tack-riveted.
- (b) if the angles are connected on the opposite sides of a 10 mm gusset plate and the angles are properly tack-riveted.

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7. Calculate the safe load for the column as shown in Figure 5. Effective length of the column is 5.5 m.

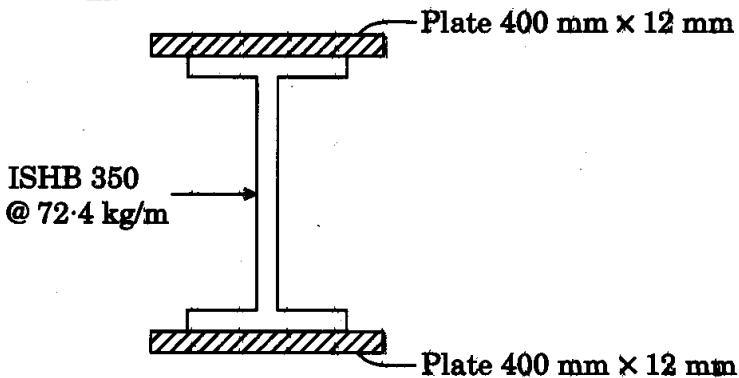


Figure 5

Values of allowable axial compression σ_{ac} for various slenderness ratio are as below :

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l/r (min)	σ_{ac} (N/mm ²)
10	150
20	148
30	145
40	139
50	132
60	122
70	112
80	101
90	90

8. (a) Discuss the steps to design a beam (flexural member). 5
- (b) Discuss the types of roof trusses. Also explain the loads acting on the trusses. 5
- (c) Discuss the advantages and disadvantages of welded joints as compared to riveted joints. 4
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