

**Diploma in Civil Engineering/Advanced Level  
Certificate Course in Civil Engineering  
DCLEVI/ACCLEVI**

**Term-End Examination      01082  
December, 2011**

**BCE-032 : THEORY OF STRUCTURES-I**

*Time : 2 hours*

*Maximum Marks : 70*

---

**Note :** *Question No. 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. Use of scientific calculator and steel tables is permitted.*

---

1. Choose the most appropriate answer from the following alternatives in each case : **7x2=14**

(a) The maximum pitch between any two adjacent revets is lesser of :

(i) 12 t or 200 mm

(ii) 16 t or 200 mm

(iii) 92 t or 300 mm

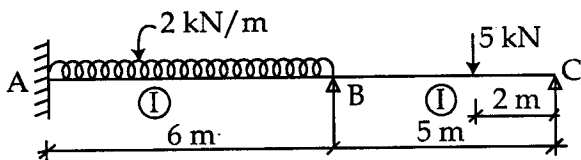
(iv) 32 t or 200 mm

- (b) The size of a butt weld is denoted by its effective throat thickness. But in case of incomplete penetration the effective throat thickness is taken as :
- (i) Half the thickness of the thinner part connected.
  - (ii) Half the thickness of the thicker part connected.
  - (iii) Five - eight the thickness of the thinner part connected.
  - (iv) Three-fourth the thickness of the thinner part connected.
- (c) The net cross sectional area of a rivet jointed tension member is :
- (i) Area of the mid section of the member
  - (ii) Area of the member divided by the area of rivet holes.
  - (iii) Area of the member minus area of the rivet holes.
  - (iv) Area of the member minus twice the area of the rivet holes.
- (d) The weakest section in the computation of the strength of a fillet weld is :
- (i) Side perpendicular to the load axis
  - (ii) Side parallel to the load axis
  - (iii) Throat of the fillet
  - (iv) None of these

- (e) The maximum bending moment in a purlin may be taken as :
- (i)  $WL/8$
  - (ii)  $WL/10$
  - (iii)  $WL/12$
  - (iv)  $WL/6$
- (f) The slenderness ratio of lacing flats in a built up column shall not exceed :
- (i) 100
  - (ii) 120
  - (iii) 145
  - (iv) 180
- (g) In rolled steel beams the shear force is resisted by :
- (i) flanges only
  - (ii) web only
  - (iii) top flange only
  - (iv) both the flange and web

2. (a) Draw the influence line diagram for shear force and bending for a simply supported beam AB of span 15 m for a section 'X' which is at a distance of 6 m from the left hand support. 7
- (b) Determine the maximum negative and positive shear force at 'X' of the above beam when a uniformly distributed load of 3 kN/m and of length 3 m crosses the beam from left to right. 7

3. A continuous beam of two spans ABC is loaded as shown in the figure given below. Analyse the beam to determine the support moments and reactions. Draw the bending moment and shear force diagrams for the beam. 14



4. (a) Determine the strength and efficiency of a single rivetted lap joint of 8 mm thick plates using 27 mm diameter rivets at a pitch of 80 mm. Permissible stresses in rivets in shearing bearing are 90 MPa and 270 MPa respectively. Permissible tearing stress in plate may be assumed as  $0.6 f_y$ . Plates are of steel fy 250. Sketch the plan and elevation of the joint. 7

- (b) A single U-butt weld joins to plates of 20 and 16 mm plates. Find the strength of the joint in tension if the width of the plates is 150 mm. Permissible tensile stress in butt weld is  $142 \text{ N/mm}^2$ . Sketch the plan and elevation of the joint. 7
5. A tension member consists of two 1SA  $150 \times 75 \times 10$  connected by their longer legs to a 12 mm thick gusset plate by 16 mm diameter rivets (single row). Find the net effective area of tension member and its strength in the following cases :
- (a) The angles are connected back to back on the same side of the gusset plate and are tack rivetted appropriately. 5
- (b) The angles are connected back to back on the same side of the gusset plate without tack rivets. 5
- (c) The angles are connected back to back on the opposite sides of the gusset plate and are tack rivetted appropriately. 4
6. A heavy class pipe (hollow steel tube) is used as a column. The length of the column is 3.5 m. The column is effectively held in position at both ends and restrained against rotation at one end. The nominal bore of the heavy class pipe is 110. Find the load carrying capacity of column. 14
- Properties of 110 nominal bore heavy class pipe are outer diameter 127.0 mm, thickness = 5.4 mm  
 Area of cross section =  $20.6 \text{ cm}^2$ , Radius of gyration = 4.3 cm.

7. A rolled steel joist ISMB 450 is used as a simply supported beam of 6 m span. The beam is loaded with a uniformly distributed load (vertical) of 20 kN/m and a horizontal load of 2 kN/m. Calculate the maximum tensile and compressive stresses in the beam. 14
8. Write short notes on *any four* of following :  $4 \times 3\frac{1}{2} = 14$
- (a) Loads on roof trusses.
  - (b) Biaxial bending of beams.
  - (c) Web crippling of I section beams.
  - (d) Design of angle iron purlins of a roof truss.
  - (e) Pressure on retaining walls due to liquids.
  - (f) Effective length of compression members.
  - (g) Properties of influence line diagrams.
  - (h) Various sections used as tension members in a roof truss.
-