BCE-032

Diploma In Civil Engineering

Term-End Examination

June, 2007

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 clearly. Use of calculator and steel tables is permitted.*

1. Choose the most appropriate answer from the given alternatives : *7×2=14*

(i) In determining the bearing strength of a double cover butt joint the thickness of the plate is taken as

(a) the thickness of the main plates connected

(b) the total thickness of both the cover plates

(c) least of (a) or (b)

(d) None of these

(ii) If '*l*' is the actual length of a fillet weld and 's' is its size, the effective length of the fillet weld is

(a) $(l - 4s)$

(b) $(l - 2s)$

(c) $0{\cdot}8\ l$

(d) $0{\cdot}7\ l$

(iii) In tension members composed of two flats, angles or tees tacking rivets are provided at a pitch in line not exceeding

(a) 2000 mm

(b) 1800 mm

(c) 1500 mm

(d) 1000 mm

(iv) The maximum slenderness ratio of a compression member carrying compressive loads resulting from dead and superimposed loads should not exceed

(a) 180

(b) 250

(c) 350

(d) 400

(v) Lacings or battens in compound columns are designed for a transverse shear force of

(a) 1·5% of the axial load

(b) 2·0% of the axial load

(c) 2·5% of the axial load

(d) 3·0% of the axial load

(vi) Rolled steel I-sections are most commonly used as beams because they provide

(a) greater lateral stability

(b) large moment of inertia with less sectional area

(c) large moment of resistance when compared with other sections

(d) All the above

(vii) An I-section purlin of span 4 m in a roof truss is subjected to a uniformly distributed load of 1250 N/m. The purlin will be designed for a maximum bending moment of

(a) 2000 Nm

(b) 2500 Nm

(c) 3000 Nm

(d) 3600 Nm

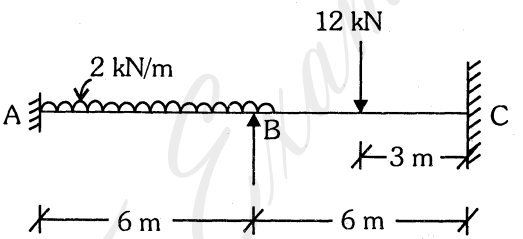
2. (a) Determine the strength and efficiency of a single rivetted lap joint of 8 mm thick plates using 27 mm diameter rivets at a pitch of 80 mm. Sketch the plan and elevation of the joint. Allowable stresses in rivets in shear 90 MPa, Bearing 270 MPa and Tearing 150 MPa. 7

(b) A single U-butt weld joins two plates of 20 mm and 16 mm thickness. Find the strength of the joint in tension if the width of the plates is 150 mm. Sketch the plan and elevation of the joint. Adopt allowable tensile stress in butt weld = 142 MPa. 7

3. (a) Draw the influence line diagrams for shear force and bending moment for a cantilever beam of span 5 m at a section X which is at 3 m from the free end of the beam. *7*

(b) For the beam in question 3(a), determine the maximum shear force and bending moment at X when two connected wheel loads of 10 kN each at a fixed distance of 3 m rolls from left to right. *7*

4. Analyse the continuous beam shown below and draw the bending moment and shear force diagrams. Calculate the support reactions also. *14*



5. (a) A tension member consists of two ISA 150 × 75 × 10 which are 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 the tension member under the following conditions : *3×3=9*

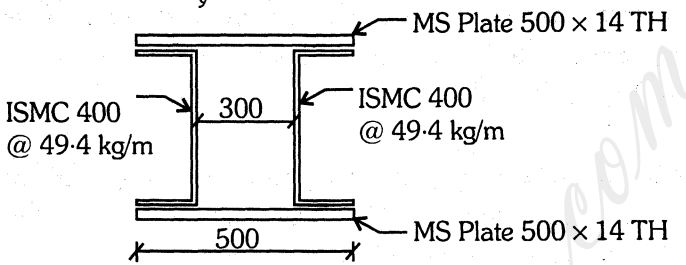
(i) The angles are connected on the same side of the gusset plate and tack rivetted.

(ii) The angles are connected on the same side of the gusset plate without tack rivets.

(iii) The angles are connected on the opposite sides of the gusset plate and are tack rivetted.

(b) Find the strength of the tension member in the above mentioned three conditions (f_y = 250 MPa). *5*

6. Calculate the safe load carrying capacity of a column shown below. Effective length of the column is 6 m and steel is of grade f_y = 250 MPa. *14*



The allowable axial compressive stresses for different slenderness ratios are as below :

l/r	σ_{ac}
10	150
20	148
30	145
40	139
50	132
60	122
70	112
80	101
90	90
100	80
110	72
120	64

7. State the two moment area theorems.

A simply supported beam AB of 6 m span carries a load of 12 kN/m over the entire span. Using these moment area theorems calculate the slopes and deflection at the supports and centre of the beam. Adopt $E = 2 \times 10^5$ MPa and $I = 30 \times 10^6$ mm^4. *14*

8. In a trussed roof building, steel trusses are supported on RCC columns. Show the key plan and elevation of the building and explain the following terms : *14*

(i) Pitch

(ii) Truss spacing

(iii) Ridge line

(iv) Top chord

(v) Eaves line

(vi) Bottom chord

(vii) Purlin