KATHMANDU UNIVERSITY
End Semester Examination
January 2025

Marks Scored:

Level : B.E.
Year : IV

Course : CIEG 402
Semester : I

Exam Roll No. :

Time: 30 mins.

F. M. : 10

Registration No.:

Date : 27-Jan-025

*Use of code IS 800:2007, IS 883:1994 & IS 875: 1987 is **NOT ALLOWED** in this section.*

SECTION "A"
[20Q. × 0.5 = 10 marks]

Choose the most appropriate answer and **encircle**.

1. Which of the following statement is ***CORRECT***?
   a. The local buckling can be prevented by adopting lower thickness of elements.
   b. Flexible connections can transfer both shear and moments.
   c. Steel structures have smaller weight-to-strength ratio.
   d. The failure mode of the structure can be visualized in Working Stress Method of design.

2. The minimum spacing for 16mm dia. bolts as per IS 800:2007 is:
   a. 40mm b. 24mm c. 28mm d. 48mm

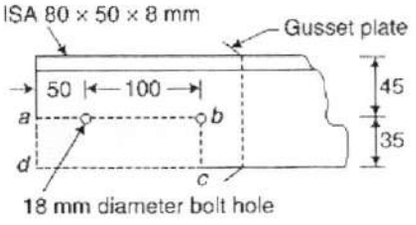
3. When the line of action of eccentric load is in the plane of group of bolts, the bolt group is subjected to:
   a. Shear Only b. Shear and Tension
   c. Tension Only d. Shear and Torsion

4. The maximum size of fillet weld that can be applied for rounded toe of ISA 100×100×10 mmm as per IS 800:2007 is:
   a. 8.5mm b. 7.5mm c. 6.5mm d. 5.5mm

5. Extra weld metal which makes the throat dimension at least 10% greater than the thickness of the welded material is called as:
   a. Reinforcement b. Throat thickness
   c. Size of weld d. Effective area of weld

6. The design tensile strength of plate due to rupture of critical section as per IS 800:2007 is:
   a. $0.9A_nf_u\gamma_{m1}$ b. $0.9A_n\gamma_{m1}/f_u$ c. $0.9A_nf_u/\gamma_{m1}$ d. A_nf_u/γ_{m1}

7. For an angle section ISA 80×50×8mm shown in figure, the net area in shear and tension planes are respectively:
   a. 1200 & 280 mm^2
   b. 912 & 136 mm^2
   c. 984 & 208 mm^2
   d. 584 & 360 mm^2



8. As per IS 800:2007, the slenderness ratio for lacing bars shall not exceed:
   a. 300 b. 145 c. 50 d. 125

9. Which of the following statement is ***CORRECT***?
   a. Sections with buckling class 'a' have lower load carrying capacity than sections with buckling class 'c'.
   b. The design compressive stress of column depends upon slenderness ratio and ultimate stress of steel.
   c. The capacity of laced and battened columns are always less than that of solid wall columns.
   d. The effective length for a column with both end fixed is higher than that with both end hinged.

10. If the flange width of steel column is 150mm then the minimum width of concrete casing is:
    a. 250mm b. 300mm c. 200mm d. 350mm

11. The design bending strength (M_d) for a simply supported beam shall be less than or equal to:
    a. $1.2Z_e f_y \gamma_{mo}$ b. $1.5Z_e f_y \gamma_{mo}$ c. $1.5Z_e f_y / \gamma_{mo}$ d. $1.2Z_e f_y / \gamma_{mo}$

12. An ISMB 500 section beam is supported on bearing plate of width 75mm at supports. The width of web required for calculating the web buckling strength is:
    a. 575mm b. 325mm c. 250mm d. 175mm

13. For a plate girder, if only one longitudinal stiffener is provided, it will be at a depth of _____ from the compression flange, where 'd' is the depth of web.
    a. $0.5d$ b. $0.4d$ c. $0.3d$ d. $0.2d$

14. For a gantry girder, the horizontal force transverse to rails for electric overhead cranes is taken as_____ of the weight of crab and weight lifted on the crane.
    a. 5% b. 10% c. 15% d. 25%

15. A structure is to be constructed where basic wind speed is 50 m/s, risk factor is 1.05, terrain and size factor is 0.96, topographic factor is 1.1. The design wind pressure would be about:
    a. 1648 N/m^2 b. 1725 N/m^2 c. 1844 N/m^2 d. 1978 N/m^2

16. The self-weight of the truss ($in\ N/m^2$) can be calculated using the formula:
    a. $3.33L + 50$ b. $3.33L - 50$ c. $2.33L + 50$ d. $2.33L - 50$

17. A square solid wood column has a dimension of 200mm. The maximum unsupported length of column that can be provided to make the column short is:
    a. 1.6m b. 2.2m c. 3.0m d. 2.4m

18. For a built-up wooden column, the slenderness ratio is calculated as:
    a. $\left(\frac{S}{d_1^2+d_2^2}\right)^{0.5}$ b. $\frac{S}{\sqrt{d_1+d_2}}$ c. $\frac{S}{d_1^2+d_2^2}$ d. $\frac{S}{\sqrt{d_1^2+d_2^2}}$

19. For a timber beam, the form factor shall not be applied for beams having depths less than:
a. 250mm b. 300mm c. 350mm d. 400mm

20. All timber flexural members having a depth exceeding three times its width and or a span exceeding fifty times its width or both shall be laterally restrained from twisting or buckling and the distance between such restraints shall not exceed _____ times its width.
a. 50 b. 40 c. 70 d. 100

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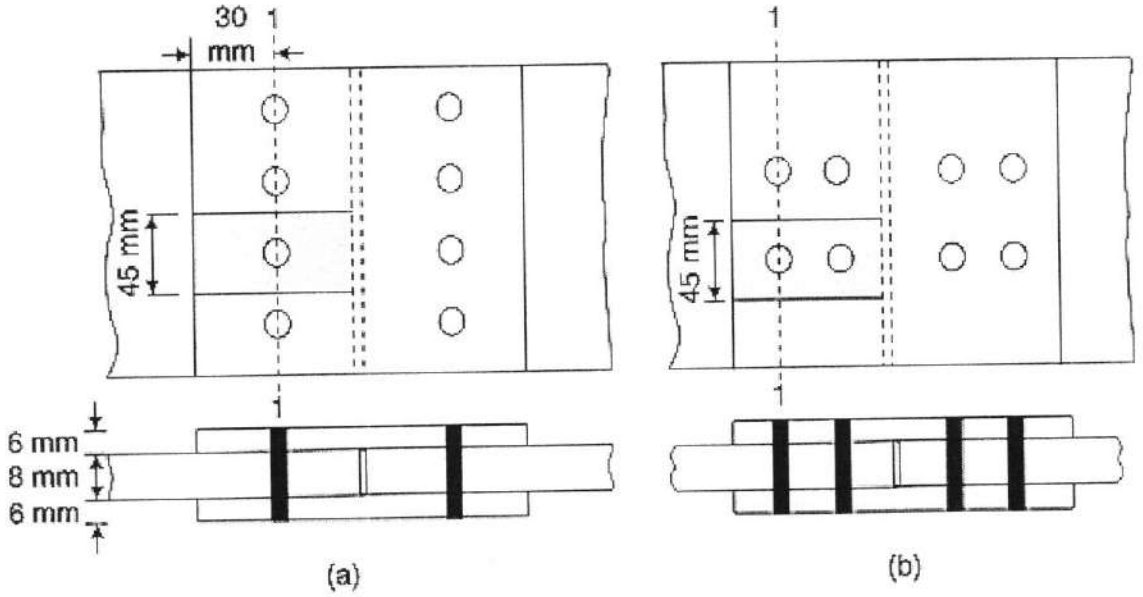
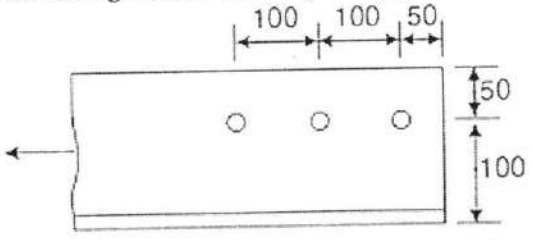
SECTION "B"
[40 marks]

Attempt *ALL* questions. *Make a suitable assumptions if necessary.*
Use of code IS 800:2007, IS Handbook no. 1/ IS 808: 1989, IS 883:1994, IS 875: 1987 is allowed.

1. A single-bolted double-cover butt joint is used to connect two plates of grade Fe410 which are 8 mm thick. Assuming 16 mm diameter bolts of ultimate stress 400 MPa and cover plates to be 6 mm thick, calculate the strength and efficiency of the joint, if 4 bolts are provided in the bolt line at a pitch of 45 mm as shown in Figure (a). Also, determine the efficiency of the joint if two lines of bolts with two bolts in each line have been arranged to result in a double-bolted double-cover butt joint (Figure b). [7]



2. An ISA 150 × 75 × 10 mm angle shown in Figure is connected with three 20 mm bolts. Determine its block shear strength. Use Fe410 (E250) grade steel. [4]



3. Design a built-up column 9 m long to carry a factored axial compressive load of 1100 kN. The column is restrained in position but not in direction at both the ends. Design the column with connecting system as battens with bolted connections. Use two channels placed toe-to-toe (front-to-front). Use steel of grade Fe410 and bolts with ultimate stress 400 MPa. [10]

P.T.O.

4. A conference hall 8 m × 18 m is provided with a 120 mm RCC slab over rolled steel beams spaced 3 m c/c. A wearing coat of 100 mm average thickness is provided over the roof. Design the beam section if, the compression flange of the beam is laterally supported throughout. Check for deflection of beam also. Use Fe410 grade steel. Assume unit weight of wearing coat as 20 kN/m^3. [7]

5. Design an I-section purlin, for an industrial building situated in Kathmandu, to support a galvanised corrugated iron sheet roof for the following data: [7]
Spacing of the truss c/c = 6.0 m
Span of truss = 12.0 m
Slope of truss = 30°
Spacing of purlins c/c = 1.5 m
Intensity of wind pressure = 2 kN/m^2
Weight of galvanised sheets = 130 N/m^2
Grade of steel = Fe 410

6. A built-up Sal wood column consists of a solid core 200 mm × 200 mm and four planks 50mm × 50mm. All the pieces are spiked together. The effective length of column is 3 m. Determine the safe axial load on the column. [5]