KATHMANDU UNIVERSITY
End Semester Examination
July/August, 2024

Marks Scored:

Level : B.ARCH
Year : III
Course : CIEG 341
Semester : II
Exam Roll No. :
Time: 30 mins.
F. M. : 10
Registration No.:
Date 30 JUL 2024

Use of code IS 800:2007 & IS 883:1994 is not allowed in this section.

SECTION "A"
[20 Q. × 0.5 = 10 marks]

Choose and encircle in the most appropriate option from each set of choices

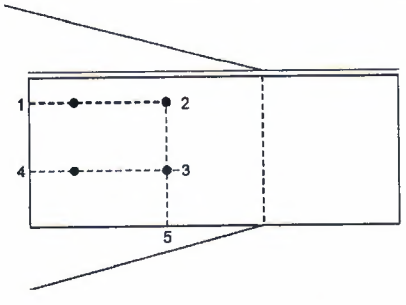
1. The minimum pitch required for bolt as per IS 800:2007 is _____, where d is the diameter of bolt.
   a. $1.5d$ b. $2.0d$ c. $2.5d$ d. $3.0d$

2. In double shear a bolt of diameter d has effective area resisting shear is:
   a. $0.78\frac{\pi}{4}d^2$ b. $1.56\frac{\pi}{4}d^2$ c. $1.85\frac{\pi}{4}d^2$ d. $2.0\frac{\pi}{4}d^2$

3. When welding is carried out, the length of the weld should be:
   a. Effective length only
   b. Effective length + size of weld
   c. Effective length + 2 × size of weld
   d. Effective length + 4 × size of weld

4. If a fillet weld is to the square edge, the size of weld shall be at least _____ less than the edge thickness.
   a. 1.5mm b. 2.0mm c. 2.5mm d. 3.0mm

5. In the four bolt connection shown in figure below, the block shear strength is along:



   a. 1-2-3-4
   b. 1-2-3-5
   c. Anyone of (a) & (b)
   d. None of the above

6. The design tensile strength of member is taken as:
   a. Design strength due to yielding of gross section
   b. Design strength due to rupture of critical section
   c. Design strength due to block shear
   d. Smaller of (a), (b) and (c)

7. Lacing and battening of columns is done to increase _____ of column.
   a. Sectional area
   b. Least radius of gyration
   c. Section modulus
   d. Slenderness ratio

8. The effective slenderness ratio of laced columns shall be taken as _____ times the maximum slenderness ratio of the column
   a. 1.05 b. 1.10 c. 1.15 d. 1.20

9. The compressive strength of concrete (f_{ck}) is given as 25 N/mm^2. Taking bearing strength of concrete as $0.45f_{ck}$, the side of square base plate required to carry an axial load of 300 kN is:
a. 109mm b.141mm c. 163mm d. 132mm

10. The web of beam is not susceptible to buckling when it satisfies the condition:
a. $d/t_w \leq 77\varepsilon$ b. $d/t_w \leq 67\varepsilon$ c. $d/t_w \leq 87\varepsilon$ d. $d/t_w \leq 97\varepsilon$

11. Consider the following statements:
Lateral support in case of a steel beam can be achieved by
(1) embedding its compression flange in a reinforced brick slab
(2) bracing the compression flanges of adjacent beams
(3) providing shear connectors on compression flange
Of the above statements,
a. 1, 2 & 3 are correct b. Only 2 is correct
b. 2 & 3 are correct d. Only 1 is correct

12. A short timber column has unsupported length of 3m. The minimum dimension of the column section shall be:
a. 375mm b. 157mm c. 216mm d. 273mm

13. Form factor for a timber beam having circular cross-section is:
a. 1.18 b. 1.41 c. 1.81 d. 1.5

14. Which of the following is the type of framed joint in timbers?
a. Oblique scarf b. Dovetail c. Fish plate d. Tabled scarf

15. Compressive strength of masonry structure depends upon:
a. Strength of unit b. Type of mortar c. Both (a) and (b) d. Either (a) or (b)

16. Maximum slenderness ratio for a load bearing wall made with cement mortar is:
a. 8 b. 11 c. 27 d. 17

17. The area reduction factor (K_a) for masonry with section area having 0.15 m^2 is:
a. 0.925 b. 0.985 c. 0.765 d. 0.835

18. Which of the following statement is **CORRECT**?
a. Steel structures have high weight-to-strength ratio.
b. Standard steel sections have larger moduli of section in proportion to their cross-sectional areas.
c. The local buckling of plate elements of steel sections can be prevented by adopting smaller thickness of elements.
d. Local buckling of plate elements enhances the load carrying capacity of the member.

19. In working stress design method, factor of safety is applied for:
a. Material strength b. Loads c. Deflection d. Both (a) & (b)

20. Characteristic actions are defined as:
a. The actions that are not expected to be exceeded with more than 2.5% probability during the life of the structure.
b. The actions that are not expected to be exceeded with more than 15% probability during the life of the structure.
c. The actions that are not expected to be exceeded with more than 10% probability during the life of the structure.
d. The actions that are not expected to be exceeded with more than 5% probability during the life of the structure.

KATHMANDU UNIVERSITY
End Semester Examination
July/August, 2024

Level : B.ARCH
Year : III
Time : 2 hrs. 30mins.

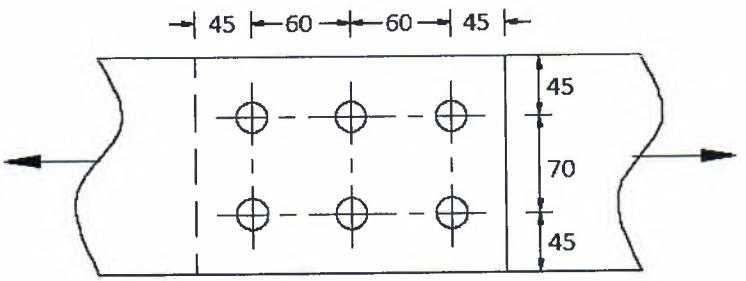
30 JUL 2024

Course : CIEG 341
Semester : II
F. M. : 40

Make a suitable assumptions if necessary.
Use of code IS 800:2007 ,808: 1989/ IS Handbook No. 1 & IS 883:1994 is allowed.

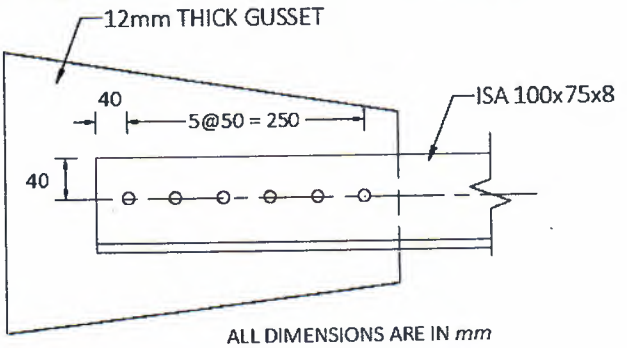
SECTION "B"
[40 marks]

1. Determine the efficiency of a lap joint shown in figure below. Use ordinary bolts of 24mm diameter and ultimate stress 400 MPa. Both plates are 16mm thick and are made up of Fe410 grade steel. [6]



ALL DIMENSIONS ARE IN *mm*

2. A single unequal angle 100×75×8 mm is connected to a 12mm thick gusset plate at the ends with 6 nos. 20mm diameter bolts to transfer tension as shown in figure. Determine the design tensile strength of the angle if the gusset is connected to the 100mm leg. The yield and ultimate strengths of steel used are 250 MPa and 410 MPa respectively. [7]



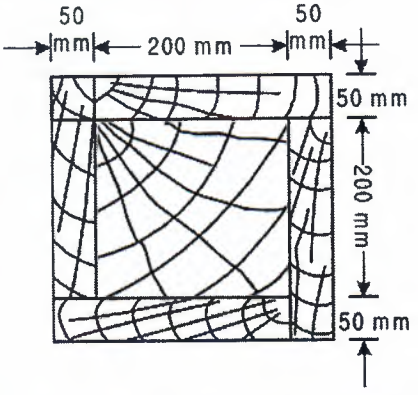
ALL DIMENSIONS ARE IN *mm*

3. Design a built-up cross section for a 8m long battened column with two channels placed back to back for supporting a service axial load of 1200 kN. The column is to be effectively held in position at both ends and restrained against rotation at one end. The grade of structural steel is Fe410. [10]

4. Design a simply supported beam of span 4m carrying a reinforced concrete floor capable of providing lateral restraint to the top compression flange. The factored uniformly distributed load is made up of 30 kN/m imposed load and 30 kN/m dead load. Assume Fe410 grade steel. Perform necessary checks. [7]

P.T.O.

5. A section of built-up Sal wood column is shown in figure below. The effective length of column is 3m. Determine the safe axial load on the column. [5]



6. A masonry wall of effective height 2.5m and thickness 200mm is made-up of concrete blocks of size 300 × 200 × 150 mm and M1 type mortar. The crushing strength of concrete block is 15 N/mm^2. The wall carries a load of 10 kN/m at its top. Check the safety of wall against compressive stress. [5]

Tables to be used for Q.N. 6:

TABLE 8 BASIC COMPRESSIVE STRESSES FOR MASONRY (AFTER 28 DAYS)

(Clause 5.4.1)

Sl No.	Mortar Type (Ref Table 1)	Basic Compressive Stresses in N/mm^2 Corresponding to Masonry Units of Which Height to Width Ratio does not Exceed 0·75 and Crushing Strength in N/mm^2 is not less than										
		3·5	5·0	7·5	10	12·5	15	17·5	20	25	30	35
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1	H1	8·35	0·50	0·75	1·00	1·16	1·31	1·45	1·59	1·91	2·21	2·5
2	H2	8·35	0·50	0·74	0·96	1·09	1·19	1·30	1·41	1·62	1·85	2·1
3	M1	8·35	0·50	0·74	0·96	1·06	1·13	1·20	1·27	1·47	1·69	1·9
4	M2	0·35	0·44	0·59	0·81	0·94	1·03	1·10	1·17	1·34	1·51	1·65
5	M3	0·25	0.41	0·56	0·75	0·87	0·95	1·02	1·10	1·25	1·41	1·55
6	L1	0·25	0·36	0·53	0·67	0·76	0·83	0·90	0·97	1·11	1·26	1·4
7	L2	0·25	0·31	0·42	0·53	0·58	0·61	0·65	0·69	0·73	0·78	0·85

TABLE 9 STRESS REDUCTION FACTOR FOR SLENDERNESS RATIO AND ECCENTRICITY

(Clause 5.4.1.1)

Slenderness Ratio	Eccentricity of Loading Divided by the Thickness of the Member					
	0	1/24	1/12	1/6	1/4	1/3
(1)	(2)	(3)	(4)	(5)	(6)	(7)
6	1·00	1·00	1·00	1·00	1·00	1·00
8	0·95	0·15	0·94	0·93	0·92	0·91
10	0·89	0·88	0·87	0·85	0·83	0·81
12	0·84	0·83	0·81	0·78	0·75	0·72
14	0·78	0·76	0·74	0·70	0·66	0·66
16	0·73	0·71	0·68	0·63	0·58	0·53
18	0·67	0·64	0·61	0·55	0·49	0·43
20	0·62	0·59	0·55	0·48	0·41	0·34
22	0·56	0·52	0·48	0·40	0·32	0·24
24	0·51	0·47	0·42	0·33	0·24	—
26	0·45	0·40	0·35	0·25	—	—
27	0·43	0·38	0·33	0·22	—	—

TABLE 10 SHAPE MODIFICATION FACTOR FOR MASONRY UNITS

(Clause 5.4.1.3)

Height to Width Ratio of Units (As Laid)	Shape Modification Factor (k_p) For Units having Crushing Strength in N/mm^2			
	5·0	7·5	10·0	15·0
(1)	(2)	(3)	(4)	(5)
Up to 0·75	1·0	1·0	1·0	1·0
1·0	1·2	1·1	1·1	1·0
1·5	1·5	1·3	1·2	1·1
2·0 to 4·0	1·8	1·5	1·3	1·2

Note — Linear interpolation between values is permissible.