

Th2 Structural Design-II

Full Marks: 80

Time- 3 Hrs

Answer any five Questions including Q No.1& 2
Figures in the right hand margin indicates marks

1. Answer **All** questions 2 x 10
 - a. What do you mean by bearing type bolt ?
 - b. What is limit state of collapse?
 - c. Differentiate between web buckling and web crippling .
 - d. Define edge distance and end distance.
 - e. Define load bearing and non-load bearing walls.
 - f. Calculate the diameter of bolt hole for M14,M24,M27 bolt.
 - g. Define slenderness ratio and radius of gyration.
 - h. Define butt weld and fillet weld.
 - i. Write the full form of HFS and ERW.
 - j. What do you mean by staggered pitch ?
2. Answer **Any Six** Questions. 5 x 6
 - a. Explain block shear failure.
 - b. What is round tubular section also write their advantages. .
 - c. Explain the different types of beam sections used in design according to slenderness ratio .
 - d. A steel tubular column of 4.8 m length is hinged at both ends,it has nominal diameter of 225 mm and is confirm to YST 32 grade . Determine safe load carrying capacity of the column.
 - e. Calculate the net area of a plate section having width of plate as 180mm and connected by a bolt of 20 mm diameter and thickness of plate is given as 15mm.
 - f. Calculate shearing strength and bearing strength of 10.9 class M30 HSFG bolt,connect with 10mm thick plate.
 - g. Write about load bearing type and non load bearing type masonry walls.
3. Answer **Any Three** Questions.
 3. A tension member consists of a flat 100mm X 75mm X 8 mm is connected to a gusset plate of 10mm thick with 3 bolts in a line of M20 bolts at a pitch of 60mm for tension member. Determine the block shear strength. If steel grade Fe410 and bearing bolts of property class 4.6 are used . Take gauge 40mm and edge distance 40mm. 10
 4. Determine the design axial load capacity of the column ISHB 300@577 N/m if the length of column is 3m and its both ends pinned. 10
 5. Describe factors affecting the strength of a tubular section. 10
 6. Design a suitable fillet weld to connect a tie bar 60mm X 8mm to a 12mm thick gusset plate so as to develop maximum force if 5+5
 - (i)Shop welding is done on two sides
 - (ii)Field welding is done on three sides.Assume all necessary data.
 7. Design a simply supported beam of effective span of 1.5 m carrying a factored load of 360 KN at mid span. Assume all necessary data. 10

5TH SEM ./ CIVIL / 2023(W) NEW
Th-2 STRUCTURAL DESIGN-II

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Answer any five Questions including Q No.1& 2
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(Steel table, IS 800, SP20, IS1161 and IS806 are allowed in exam)

1. Answer **All** questions 2 x 10
- a. Define gauge.
 - b. For bolts of property class 4.6, what do the number 4 and 6 indicate.
 - c. State the types of welds.
 - d. What are the types of mortar?
 - e. Where do you recommend HSFG bolts?
 - f. What is web crippling?
 - g. For what type of structures, tubular steel sections are suitable?
 - h. What do you mean by partial safety factor in limit state of design?
 - i. What is load bearing masonry wall?
 - j. Define net section area of a tension member.
2. Answer **Any Six** Questions 5 x 6
- a. Write down the special consideration in steel design.
 - b. Mention the advantages of welded connection over bolted connection.
 - c. Two plates 8mm and 12mm thickness are to be joined using longitudinal fillet weld. Suggest a suitable size of weld and length of the end returns.
 - d. Explain block shear failure in tension members.
 - e. Calculate the design compressive load for an ISHB 350@ 710.2 N/m, 3.5m high. The column is restrained in direction and position at both the ends. It is to be used as a column in a single storey building. Use steel of grade Fe410. Use table of IS code for calculation of f_{cd} .
 - f. What are classification based on cross section for steel beams?
 - g. Write down the codal provision of design consideration of masonry walls.
3. A tension member consists of a flat 120mm X 8mm is connected to a gusset plate of 12mm thick of 02 numbers of M20 bolts of property class 4.6. Determine the strength of tension member. Use steel of grade Fe410. 10
4. Design a column to support a factored load of 1050kN. The column has an effective length of 7.0m w.r.t. z-axis and 5m w.r.t. y-axis. Use steel of grade Fe410. 10
5. Design a simply supported beam of effective span 1.5m carrying a factored concentrated load of 360kN at mid span. 10
6. Describe the factors affecting the strength of a tubular section. 10
7. Design a brick masonry column of height 3m, tied effectively, fixed at top and bottom. The load from slab is 100kN, including self weight of the brick pillar. 10

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Answer any five Questions including Q No.1& 2
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1. Answer **All** questions 2 x 10
 - a. What do you mean by efficiency of joint ?
 - b. What is the relation between yield strength and ultimate strength of bolt?
 - c. What is slenderness ratio?
 - d. Define local buckling.
 - e. What is web buckling and web crippling ?
 - f. What is the basic difference between bearing type and HSFG bolts?
 - g. What are the possible failure criteria for tension member?
 - h. Write full form of HFS & ERW ?
 - i. What is radius of gyration?
 - j. What is fillet weld ?
2. Answer **Any Six** Questions 6 x 5
 - a. State all the assumption taken for design of bearing bolts.
 - b. Select a suitable angle section to carry a factored tensile force of 170 KN assuming a single row of M20 bolts and assuming design strength as $F_y=250$ MPa.
 - c. What are the different types of beam sections used in design according to slenderness value?
 - d. What are the types of welds used in steel design explain with neat sketch.
 - e. Determine the plastic moment capacity and plastic section modulus of a symmetrical 'I' section having depth of section as 300mm and width 150mm. Thickness of flange is 14.2 mm and thickness of web is 8.1 mm about z-z axis.
 - f. A butt weld is used to connect two plates of 180mm x 18mm each. Find out the stress developed in the weld if it is subjected to a moment of 13000 KN mm.
 - g. Why tubular sections are preferred over other steel sections?
3. Design a lap joint between two plates each of width 120 mm, if thickness of one plate is 20mm and the other is 11 mm. The joint has to transfer a design load of 240 KN, the plates are of Fe410 grade use bearing type bolts of property class 4.6. 10
4. A tension member consists of a flat 120mm x 8mm is connected to a gusset plate of 12mm thick by 2 numbers of M20 bolts. If steel grade Fe410 and bearing bolts of property class 4.6 are used in field, determine the strength considering all failure criteria. 10
5. Calculate the factored axial load on the column section ISHB 400 @ 806.38 N/M. The height of column is 3.0 m and it is pin ended use steel of Fe410 grade. 10
6. Design a simply supported beam of effective span 1m carrying a factored concentrated load of 360KN at mid span. 10
7. Describe factors affecting the strength of a tubular section. 10

V-SEM./ CIVIL ENGG./ 2021(W)

TH-II STRUCTURAL DESIGN-II

Full Marks: 80

Time- 3 Hrs

Answer any five Questions including Q No.1 & 2
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1. Answer **All** questions

2 x 10

- a. With a neat sketch give examples of bolted connection with single shear plane and double shear plane.
- b. Differentiate between limit states of strength and limit state of serviceability.
- c. What do you mean by crinkling in tubes?
- d. What is slenderness ratio of a masonry wall?
- e. What will be the buckling class of ISHB 450@ 925 N/m about Z-Z and Y-Y axis?
- f. What is the minimum and maximum value of pitch of bolts in a tension member?
- g. Define Bolt value.
- h. What are the types of mortar?
- i. What is the recommended throat thickness for incomplete penetration butt weld welded from one side only?
- j. What do you mean by HSFG bolts?

2. Answer **Any Six** Questions

5X6

- a. Write down the advantages of welded connection over bolted connection.
- b. Design a single angle tension member of a roof truss to carry a factored tensile load of 225 KN. The member is subjected to the possible reversal of stresses due to action of wind. The length of member is 3 metre. Use 20mm shop bolts of grade 4.6 for the connection. Assume any other suitable data.
- c. Explain about buckling class of cross sections in compression member.
- d. Write short note on design consideration for masonry wall footing.
- e. Write short note on web buckling and web crippling.
- f. A tubular Steel column of 4.8m length is hinged at both ends. It has nominal diameter of 225 mm and conforms to yst 25 grade. Determine the safe load carrying capacity of the column.

- g Write the difference between limit state method and working stress method.
- 3 Design a steel column section using channel section only to carry factored axial load of 400 kN. The column is 4 m long and is effectively held in position at both ends but restrained against rotation at one end. Consider $f_y = 250$ MPa. Assume any other suitable data. 10
- 4 Determine the load carrying capacity of a brick masonry column at its base for following data. 10
 Effective height = 3.5 m,
 Column section = 400 mm \times 400 mm
 Grade of mortar = M2
 Average compressive strength of bricks = 7.5 N/mm²
 Assume modular bricks and racked joints.
- 5 A laterally supported beam ISMB 600 @ 120.271 N/m is placed between two supports. Determine the safe uniformly distributed load the beam can carry for an effective span of 8 m. Take $f_y = 250$ N/mm². Neglect web buckling and web crippling. 10
- 6 Find the maximum force that can be transmitted through a double bolted chain lap joint consisting of 6 bolts in two rows. Given that M16 bolts are 4.6 grade and plates are of Fe410. The thickness of the plates connected are 10 mm and 12 mm. 10
- 7 Design a welded lap joint for two plates of size 120 mm \times 8 mm and 120 mm \times 12 mm for maximum efficiency. Assume shop welding and Fe410 grade of Steel. 10

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IS800:2007, IS 883-1970, SP 20, IS 806-1968, IS 1161-1998 and steel table are allowed in examination.

1. Answer All questions 2 x 10
 - a. Define crinkling in tubular Steel compression member.
 - b. Define structural Steel.
 - c. Define gauge distance
 - d. What do you mean by slot weld and plug weld?
 - e. Differentiate between web buckling and web crippling of beams.
 - f. What is effective length of a column?
 - g. Define net sectional area of a tension member.
 - h. What is slenderness ratio of a masonry wall?
 - i. For what type of structure is the tubular Steel sections are suitable?
 - j. What do you mean by mortar and what are the types of mortars?
2. Answer Any Six Questions 6 x 5
 - a. Write down the advantages and disadvantages of steel structure.
 - b. Explain block shear failure in tension members.
 - c. Explain different types of butt welds with neat sketch.
 - d. A ground floor masonry wall is 4m clear height up to bottom of roof slab. Height of plinth above foundation footing is equal to 0.8 metre. If the wall thickness is 30 cm, calculate effective height and slenderness ratio for partial restraint on both ends condition.
 - e. Determine the tensile strength of a roof Truss 100×75× 10 mm connected to the gusset plate with 100 mm leg by 5 mm fillet weld with length of weld equal to 200 mm. Take $f_y=250\text{N/mm}^2$.
 - f. Determine the plastic moment capacity of unsymmetrical I section. Given specifications are:

Top flange- 100 mm × 20 mm

Bottom flange- 200 mm × 20 mm

Web- 200 mm × 20 mm

- g What do you mean by slip critical connection? Explain the principle of high strength friction grip bolts.
- 3 Find the maximum force that can be transmitted through a double bolted chain lap joint consisting of 6 bolts in two rows at pitch and gauge distances of 40mm. Given that M16 bolts are of grade 4.6 and plates of fe410 are used. The thickness of the plates connected are 10mm and 12 mm. Take end distance and edge distance as 30mm. 10
- 4 A laterally supported beam ISMB 600 @1226 N/m is placed between two supports. Determine the safe uniformly distributed load the beam can carry for an effective span of 8 m. Take $f_y=250\text{N/mm}^2$. Neglect web buckling and web crippling. 10
- 5 Design a column section to carry a working axial load of 400 KN. The column is 4 metre long and effectively held in position and restrained against rotation at both ends. Consider $f_y=250\text{N/mm}^2$. 10
- 6 Write the codal provisions of design consideration for masonry walls under eccentric loading. 10
- 7 A tie member of a roof Truss consists of two ISA 100 75,8 mm. The angles are connected to either side of a 10mm gusset plate and the member is subjected to a working pull of 300 KN. Design the welded connection, assuming connections are made in workshop. 10

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