Assignment No: 01

Date: 04-08-2022

PHILOSOPHY OF LIMIT STATE DESIGN FOR STEEL

Sub Code 3150612 **Title of Subject** DESIGN OF STRUCTURES

#	Questions
1	Explain Working stress method and Limit state method of structural Design Philosophy
2	Discuss the various philosophies of the design in R. C. C. and steel structures. Also discuss the merits and demerits of each.
3	What is the difference between Mild steel and HYSD steel? Also state the few characteristics of both types of steel.
4	Explain briefly, the various Limit States of design.
5	Give the full forms of the following acronyms: RCC, HYSD, TMT

Assignment No: 02

Date: 04-08-2022

DESIGN OF TENSION MEMBER

Sub Code 3150612 **Title of Subject** DESIGN OF STRUCTURES

INSTRUCTION:

1. **Use of IS: 800 (2007), IS: 456 (2000) and Steel Table is permitted.**
2. **Assume the Ultimate and Yield stress of steel as 410 N/mm^2 and 250 N/mm^2 respectively unless it is mentioned.**

#	Questions
1	A single equal-leg angle 100 X 100 X 10 mm is connected to a gusset plate of 10 mm thick at the ends with 6 bolts of 20 mm diameter in a single line at a gauge distance of 60 mm to transfer tensile force. Determine the design tensile strength of the angle. Assume edge distance as 40mm & pitch for the bolts as 50mm.
2	A tension member comprises of the single angle ISA 90 X 60 X 6 mm is connected by 7 nos. of 16 mm diameter bolt to the 10 mm thick gusset plate. Calculate the capacity of the member if shorter leg is connected.
3	A single unequal angle section 100 X 75 X 6 mm is connected to an 8 mm thick gusset plate at the ends with 6 no's of 18 mm diameter bolts to transfer tension. Determine the design tensile strength of the angle assuming that the yield and ultimate stress of steel used are 250 MPa and 410 MPa. Assume that the longer leg is connected to the gusset plate.
4	A truss member is analyzed and found that following loads are acting on it. 1) Dead Load = 100 kN (Tension) and 2) Live Load = 75 kN (Tension). If the length of the member is 2.0 m between the connections and is connected to the 8mm thick gusset plate, design the member comprising of 2 unequal angle sections longer leg connected to gusset plate. Assume that the member is connected to gusset plate by 7 nos. 16mm bolts.
5	What do you mean by "LUG ANGLE"? Design a tension member of a roof truss to carry a factored axial tension of 350 kN using lug angle.
6	Design a tension member to carry a tensile load of 150 kN. Select suitable single angle assuming a single row of M-20 bolt of 4.6 grade. Take fy = 250 N/mm^2.
7	Design a tie member of roof truss subjected to working loads of 80 kN (Dead Load) and 120 kN (Live Load). Use double angle section connected back-to-back on either side of gusset 8 mm thick. Use bolted connection. fy = 250 MPa and fu = 410 MPa for both member and bolt material. What will be the capacity if the angles are connected on the same side of the gusset plate?
8	Design a tension member to carry a factored load of 260 KN. Use single unequal angle section with 6 mm fillet weld used to connect to the gusset plate of thickness 8 mm. Assume length of the member 3.5 m and fu for plate is 410 Mpa.

Assignment No: 03
Date: 04-08-2022

DESIGN OF COMPRESSION MEMBER

Sub Code 3150612 **Title of Subject** Design of Structural [Steel]

#	Questions
1	Explain different end conditions of columns with their effective length
2	What is difference in behavior of short and long compression members?
3	Determine axial compressive load carrying capacity of a 2.3 m long single angle strut ISA 75 X 50 X 8 mm. The longer leg is connected to the gusset plate with two bolts at each end. Assume hinged condition.
4	Calculate compressive strength of 2 ISA 80 X 80 X 8 mm placed on either side of gusset plate 8 mm thick with effective held in position at both ends but restrained against rotation at one end. The length of member is 3 m and fy is 250 MPa.
5	Calculate the Compressive strength of a single ISA 100 X 65 X 6 mm @ 7.6 kg/m with the length of member 3.0 m. The ends of the supports are hinged. Assume that the load is applied concentrically to the angle. Take fy = 250 MPa. (i) it is connected by 1 bolt at each end.
6	A double angle discontinuous strut consists of 2 – ISA 75 X 75 X 8 mm placed on the same side of the gusset plate of 10 mm thickness and tack bolted. The length of the member is 3.2 m between the intersections. Determine the compressive strength of the member. Assume Fu 410 MPa and fy 250 MPa. Strut is hinged at both the ends.
7	Design a column of I – section in a building subjected to axial factored compressive load of 900 kN. The height of column is 4.5 m with both ends fixed. It is braced in order to prevent buckling about the weaker axis at a half the length of the column.
8	An ISMB500 is loaded by a factored compressive load of 500 kN at the midpoint of the flange. Check the safety of the column if the effective length for both axial and bending is 2.8 m
9	A steel column is loaded by a working load of 600 kN. The length of the column is 3.4 m and is restrained against both at the one end and is restrained against translation only at the other end. Design suitable "I" section for the same.
10	A steel column comprising of two ISMC300 forming a rectangle of 300 X 300 mm. It has total length of 4.5 m and is restrained against both rotation and translation at bottom end and restrained against translation only at upper end. Calculate the maximum factored load that can be applied on the same.
11	Distinguish clearly between Lacing and Battening.

12	A built-up column with 2 ISMC 350, back-to-back, at spacing of 150 mm, is carrying an axial load of 1000 kN. Length of column is 9 m. It is held in position at both ends but not restrained in direction. Design a suitable double lacing system.
13	A steel column is loaded by a working load of 600 kN. The length of the column is 3.4 m and is restrained against both at the one end and is restrained against translation only at the other end. Design suitable "I" section for the same.
14	Design a built-up column with two channels toe – to – toe to carry a factored load of 1700 kN. Take the effective length as 5.2 m. Design it as a laced column and also design the lacing.

Assignment No:	**04**	**CONNECTION OF STEEL STRUCTURES**	
Date:	**04-08-2022**		
Sub Code	**3150612**	**Title of Subject**	**Design of Structures [Steel Section]**

#	Questions
1	What are the advantages of bolted connections over riveted or welded connections?
2	Describe what you understand by class 4.6 and class 8.8 bolts?
3	A member of steel roof truss consists of two angle sections ISA 100 X 100 X 8 mm placed back to back on either side of 8 mm thick gusset plate. The member carries an ultimate tensile load of 190 KN. Design the connection if diameter of bolts provided is 20 mm of product grade 5.6. Ultimate tensile stress in the plate is 410 Mpa.
4	Design a lap joint and butt joint between two plates having thickness 12 mm and 16 mm are connected by a single bolted joint with 20 mm diameter bolts at 75 mm pitch. Calculate the efficiency of the joint. Take fu of plate as 410 MPa and assume 4.6 grade bolts
5	Design a suitable fillet weld to connect a tie plate 100 mm X 8 mm to a 12 mm thick gusset plate. The plate is subjected to load equal to tension capacity of the member. Assume shop welding. Provide only side fillets. Assume Fu 410 MPa and fy 250 Mpa.
6	Two plates of width 200 mm and thickness 10 mm are required to be designed, using welded connection for 100 percent efficiency. Use slot welds if required.

Assignment No:	**05**	**DESIGN OF FOOTING [SLAB BASE] & DESIGN OF BEAM AND BEAM - COLUMN**	
Date:	**04-08-2022**		
Sub Code	**3150612**	**Title of Subject**	**Design of Structures [Steel Section]**

#	Questions
1	Design a slab base footing for built up column consisting of two ISLC 350 back to back separated by a distance of 180 mm and carrying factored load of 1400 kN. Concrete grade M15 and steel Fe410, Bearing capacity of soil 250 kN/m^2.
2	Determine the maximum uniformly distributed load that can be carried by a laterally unrestrained ISMB 300 simply supported beam of 2.5 m effective length.
3	A simple support beam is laterally supported over the span of 8 m and loaded by a super imposed load of 30 kN/m over the entire span and 100 kN and centre. Design the beam using ISMB section and check for all the safety.

Assignment No: 01

Date: 04-08-2022

INTRODUCTION

Sub Code 3150612 **Title of Subject** DESIGN OF STRUCTURES

#	Questions
1	**Define:** i. Limit State ii. Design Strength iii. Characteristic Strength iv. Characteristic load v. Partial Safety factors vi. Design Load
2	Differentiate between working Stress & Limit State methods
3	Draw the stress Strain Curve of Concrete and explain all assumptions.
4	Explain limit State of Collapse & Limit State of Serviceability in details.
5	Calculate the followings: i. Design Strength of Fe-250 & Fe-415 ii. Tensile Strength of M20 iii. Modulus of Elasticity of M25
6	List down the criterion for the following along with the relevant Clause numbers in IS 456: 2000 Maximum diameter of reinforcement bars, Maximum spacing of the bars and Minimum Reinforcement.

Assignment No: 02
Date: 04-08-2022

Analysis & Design of Singly & Doubly RC Beam

Sub Code 3150612 **Title of Subject** DESIGN OF STRUCTURES

#	Questions
1	Sketch neatly the Design Stress and Strain Block Parameters and derive equation for Depth of Neutral Axis and Moment of Resistance for a balanced beam section.
2	Differentiate between: Under reinforced, Balanced and Over reinforced Section.
3	For a limiting section of 300 X 500 mm effective calculate the followings. Use M 15 and Fe-250 grades of materials. i. Maximum Compressive and tensile stresses in materials ii. Lever Arm iii. Total tension and compression force.
4	A reinforced concrete rectangular beam 325 mm x 625 mm deep is subjected to a uniformly distributed load 35 kN/m over a simply supported span of 6m. Design the beam for flexure using M:20 and Fe-415. Assume effective cover as 40 mm
5	A singly RC beam of size 250 X 500 mm effective is reinforced with 0.76 % of steel for Fe-500 grade and M 20 for concrete. Calculate (i) Depth of Neutral Axis (ii) Required Numbers of 18 mm φ bars (iii) Moment of resistance.
6	Design a rectangular RC beam having width of 250 mm and it is simply supported with effective span 5.0 m. it is loaded with UDL of 20 kN/m including self-weight. Use M 20 and Fe-415 Grades of materials. Check the beam for Minimum and maximum steel and also for deflection.
7	Find the Moment of Resistance of a singly reinforced concrete beam of 230 mm width and 450 mm effective depth, reinforced with 4 bars of 12 mm diameter of Fe-415 and M20 concrete. If span length is 3.5 m. find out safe working UDL on beam take effective cover as 50 mm.
8	Differentiate between Singly & Double RC beam.
9	An R. C. C. beam of size 300 wide and 500 mm deep is reinforced by tension bars as 4 nos. of 25 mm dia. and compression bars as 2 nos. of 16 mm dia. Calculate the moment of resistance of beam if the clear cover is 30 mm on both the sides.
10	Design a doubly reinforced section for a rectangular beam having an effective span of 4.0 m. The superimposed load is 40 kN/m and size of beam is 230 mm X 450 mm. Assume the suitable data. Design for the M:25 and fe-415 grades of materials

Assignment No: 03
Date: 04-08-2022

Analysis & Design of Flange Sections (T-Beams)

Sub Code 3150612 **Title of Subject** DESIGN OF STRUCTURES

#	Questions
1	Calculate the width of flange of a T beam using following data: a. Depth of flange =125 mm b. Width of rib = 425 mm c. Effective span = 7.5 m
2	An R. C. C. T-beam has breadth of flange as 1100 mm, thickness of flange 120 mm, effective depth 600 mm and width of web 230 mm. It is reinforced by 4 – 25 mm dia bars. Calculate the ultimate moment of resistance for the same.
3	Find out the Moment of resistance for the T beam with following details a. Flange = 2000 mm X 120 mm b. Rib = 250 X 430 mm c. Steel in Tension 7 – 25 mm dia bars d. Effective cover = 50 mm e. M-15 & Fe-415 grades of materials.
4	Design the T beam and find out the area of tensile steel required for the ultimate moment of 300 kNm. Following details are available: a. Flange = 1250 mm X 100 mm b. Width of Web = 250 mm c. Effective cover = 50 mm d. Overall depth = 600 mm e. M-20 & Fe-415 grades of materials.

Assignment No: 04

Date: 04-08-2022

Analysis & Design of Axially Loaded Short Columns

Sub Code 3150612 **Title of Subject** DESIGN OF STRUCTURES

#	Questions
1	What is difference in behaviour of short and long compression members?
2	Enumerate the difference between short and slender columns. State the IS-456 code specifications for: (a) Minimum eccentricity for design of columns; (b) Longitudinal reinforcement; (c) Lateral ties.
3	Determine the ultimate load carrying capacity of circular column of 400mm diameter reinforced with 6 nos of 25 mm dia + 2 nos of 20 mm dia bars. Consider M 20 & Fe-415. Assume emin is less than 0.05D.
4	Determine the ultimate load carrying capacity of rectangular column 450 X 650 mm reinforced with 6 nos of 28 mm dia bars. Consider M 25 & Fe-415. Assume emin is less than 0.05D.
5	Design the reinforcement and size of square column to support axial load of 1000 kN. Use M 20 & Fe-415 grades of materials. Take unsupported and effective length of the column is 3 m. sketch the details.
6	Design a circular column of diameter 400 mm with helical reinforcement subjected to a working load of 1200 kN. Use M 25 and Fe-415 grades. The column has unsupported length of 3 m and is effectively held in position but not restrained against rotation.
7	Design a short rectangular column to carry an axial load of 455 KN. Take M:20 grade of concrete and Fe- 415 grade of steel. Apply the check for the eccentricity. Unsupported length of column is 3 m.
8	Design a short circular column with helical reinforcement column to resist a factored axial load of 2400 KN. Provide all necessary checks and detailed sketch. Use M:25 and Fe-415.

Assignment No: 05

Date: 04-08-2022

Design of Shear Reinforcement

Sub Code 3150612 **Title of Subject** DESIGN OF STRUCTURES

#	Questions
1	A R. C. C. beam 250 mm X 500 mm effective is reinforced with 4 Nos - 16 mm diameter of Fe-415. The beam carries factored shear force of 55 KN. Find the spacing of 8 mm diameter - 2 legged – Fe-250 stirrups. Use M:20
2	A Simply R. C. C. beam of 250 mm X 500 mm effective size is supported on 5 m span and subjected to UDL of 20 kN/m over entire span and reinforced by has 4 nos. 22 mm diameter bars of Fe-415. Design the shear reinforcement if 2 nos of 22 mm dia bars are bent up at 45 degree at ends. Use M 20 grade of concrete.
3	A Simply R. C. C. beam of 300 mm X 500 mm overall size has 4 nos. 20 mm diameter bars of Fe-415 at an effective cover of 30 mm. The beam is subjected to Shear Force of 150 kN. Design the shear reinforcement. Use M-20 grade concrete & 8 mm diameter stirrups of Fe-250.

SHANTILAL SHAH ENGINEERING COLLEGE, BHAVNAGAR
APPLIED MECHANICS DEPARTMENT

B.E. (Civil Engineering) Semester – 5th

Subject Code: 3150612	**Name of Subject: Design of Structures (RCC)**
Date: 04/08/2022	**Assignment No: 06**

Design of RCC Simply Supported Slabs

#	Questions
1	Differentiate between one way & two-way slabs
2	Design a slab for room of 3 m X 7 m in size to resist live load of 3 kN/m^2 and floor finish load of 1.0 kN/m^2. Take thickness of wall is 300 mm. Use M 20 & Fe – 415 grades of materials. Do all necessary checks and draw the detailing?
3	Design a simply supported one-way slab for an effective span of 3.0 m to carry total factored load of 10.5 kN/m^2. Use M20 & Fe -250.
4	Design a slab for room of 3 m X 4.5 m effective span to resist live load of 3 kN/m^2 and floor finish load of 0.5 kN/m^2. Take thickness of wall is 300 mm. Use M 20 & Fe – 250 grades of materials. Do all necessary checks and draw the detailing. Assume corners are not held down.
5	Design a slab for room of 3.2 m X 4.2 m clear span to resist live load of 3 kN/m^2 and floor finish load of 0.8 kN/m^2. Take thickness of wall is 300 mm. Use M 20 & Fe – 250 grades of materials. Do all necessary checks and draw the detailing. Assume corners are held down.

Faculty: Prof D P Advani

Assignment No: 07

Date: 04-08-2022

Design of Foundations (Column Footings)

Sub Code 3150612 **Title of Subject** DESIGN OF STRUCTURES

#	Questions
1	Explain one-way shear check and two-way shear check for footing design.
2	Design an isolated sloped footing for the column of size 300 mm X 400 mm reinforced with 8 bars of 16 mm diameter carrying an ultimate load of 1000 kN. The safe bearing capacity of soil is 180 kN/m^2. Assume effective cover for bottom steel is 60 mm.
3	An R. C. C. column of the size 300 mm X 300 mm is loaded by a working axial compressive load of 700 kN. If the Safe Bearing capacity of the soil is 150 kN/m^2, design the suitable square slopped individual footing for the same giving check for the shear.
4	Write the design steps for the RC combined footing.

Assignment No: 08

Date: 04-08-2022

Design of Foundation

Sub Code 3150612 **Title of Subject** DESIGN OF STRUCTURES

#	Question
1	Design an isolated pad footing for a square column of 320 mm X 320 mm for axial load of 700 kN. Use M 20 & Fe – 250. Take SBC of Soil as 140 kN/m^2.
2	Define Combined footing and also write down the design steps of combined footings.