Design of Steel Structures
(3170618)

B.E. Semester 7 (Civil Engineering)

Shantilal Shah
Engineering College

Directorate of Technical Education
Gandhinagar, Gujarat

Shantilal Shah Engineering College, Bhavnagar

Certificate

This is to certify that Mr./Ms. _____ _____ Enrollment No. _____ of B.E. Semester 7th Civil Engineering of this institute (GTU Code: 043) has satisfactorily completed the tutorial work for the subject Design of Steel Structures (3170618) for the academic year _____.

Place: _____

Date: _____

Name and Sign of Faculty member

Head of the Department

Instructions for Students

(i) Use A-4 size blank pages to prepare design report

(ii) The report shall have following format (lay out)

	Main Heading	Page No.
Margin for Bullets	Sub heading Design calculation/write up	Margin to write references

(iii) Use only front side of page for write up as well as for sketches and detailing.

(iv) Mark 1½" margins on both left and right. Use left margin to show bullets and right margin to show references like clause of code/page etc.

(v) Start new design problem on new page.

(vi) Heading and sub heading shall be distinct than write up.

(vii) Support the calculation/s with neat sketches wherever required.

(viii) Attach A3 size sheets to furnish design detailing (Use AutoCAD Drawing for at-least one design problem).

(ix) All design detailing shall be strictly as per relevant IS standards.

(x) Spiral bound is preferred as it is more convenient for reading.

(xi) Student shall bring required IS codes and other references in class and tutorial hours.

Assignment – Course Outcome matrix

CO-1	Determine various types of loads acts of the framed structures and design the connections of Steel framed structure & Industrial structures.
CO-2	Prepare structural lay-out, determined loads & designed forces for different structures of the syllabus
CO-3	Apply the design principles, procedures and current Indian codal provisions for design & detailing of different structures of syllabus.
CO-4	Apply the principles of plastic design in steel beams & portal frames.

Sr. No.	**Tutorials**	**CO1**	**CO2**	**CO3**	**CO4**
1.	Design of Steel Connections	√	√	√	
2.	Design of Plate Girder	√	√	√	√
3.	Design of Gantry Girder	√	√	√	√
4.	Design of Foot Over Bridge	√	√	√	√
5.	Plastic Design	√		√	√

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(Progressive Assessment Sheet)

Sr. No.	Name of Tutorial/Assignment	Page No.	Starting Date	Date of submission	Marks	Sign. of Teacher with Date	Remarks
1	Design of Steel Connections		09/09/2024	15/10/2024			
2	Design of Plate Girder		15/07/2024	24/09/2024			
3	Design of Gantry Girder		15/07/2024	10/09/2024			
4	Design of Foot Over Bridge		12/08/2024	08/10/2024			
5	Plastic Design		23/09/2024	22/10/2024			
Total							

Assignment No: 1
Design of Steel Connections

1.1 What is moment resisting connection? List the basic types of beam to column connections.

1.2 Explain the connections with neat sketches: beam to beam web angle connection, beam to column flange seat angle connection.

1.3 Design a unstiffened seat connection for a factored beam end reaction of 150 kN. The beam section is ISMB 200 connected to the flange of column section ISHB 250 using bolted connections. Steel is of grade Fe 410 and bolts of grade 4.6

1.4 Design a bolted stiffened seat connection between ISLB 400 beam and an ISHB 250 column for transferring in-service beam end reaction of 300 kN using M20 bolts of grade 4.6. Assume Fe 410 grade of steel with yield stress 250 MPa.

1.5 A beam ISLB 300 is connected to a flange of column ISHB 300 to transmit end reaction of 150 kN due to factored loads. Design web angle connection using M 20 bolts of 4.6 grade and steel Fe 415.

1.6 Design a suitable bracket connection of ISHB 200 section attached to flange of ISHB 300 to carry a factored load of 150 kN at an eccentricity of 250 mm to the face of the column.

1.7 Two secondary beams ISMB 350 amd ISHB 550 carrying factored load of 300 kN and 450 kN respectively are connected to the web of the main beam ISMB 600. Design the suitable connection.

Assignment No: 2
Design of Plate Girder

2.1 Explain various components of Plate girder with neat sketch.

2.2 What are the applications of plate girder?

2.3 Explain simple post critical method and tension field action to calculate nominal shear strength of girder.

2.4 List the various types of stiffeners as stipulated by IS 800:2007 and their functions.

2.5 Explain pre -buckling and post -buckling behavior of web plate.

2.6 A simply supported bolted / welded plate girder of L m span is subjected to UDL of **w** kN/m, in addition to its self-weight. It is also subjected to two point loads P_1 & P_2 kN at the distance 'a' from each support for static condition.

Design,

(a) Overall section of the girder, which can satisfy stress and deflection criteria.

(b) Vertical and bearing stiffeners.

Draw neat sketch of the plate girder showing all details.

Batch	L (m)	w (kN/m)	P_1(kN)	P_2 (kN)	a (m)	Condition of load
A1, B1	24	36	250	200	5.0	Static
A2, B2	26	38	300	200	--	Moving
A3, B3	20	40	240	240	5.0	Static
A4, B4	18	32	250	220	--	Moving

Assignment No: 3
Design of Gantry Girder

3.1 Draw a schematic diagram of gantry girder showing all the components. A

3.2 Design and detail a gantry girder of capacity W using following details.

	A1, B1	**A2, B2**	**A3, B3**	**A4, B4**
Capacity W (kN)	250	300	325	225
Weight of crane girder (kN)	200	250	250	150
Wheel spacing (m)	3.0	3.0	2.8	2.6
Weight of rail (kN/m)	0.65	0.65	0.65	0.65
Weight of crab (EOT) (kN)	50	60	50	60
Edge distance (m)	1.1	1.2	1.1	1.2
Span of gantry girder (L m)	7.0	6.0	6.0	7.0
Span of crane (m)	15	14	15	14

Assignment No: 4
Design of Foot Over Bridge

4.1 Explain the types, components and applications of truss girder bridges with necessary sketches

4.2 Consider a foot over bridge for L m span and 3.0 m walkway. Select suitable configuration of truss and suggest suitable spacing of cross beams. The RCC flooring is used. Assume pedestrian load of 4.0 kN/m^2.

Design Cross girder, top chord, bottom chord, vertical and inclined members. Also prepare neat sketch showing all the details in A3 size sheet.

Batch	**A1, B1**	**A2, B2**	**A3, B3**	**A4, B4**
L (m)	24	22	20	18

Assignment No: 5
Plastic Design

5.1 Distinguish between elastic section modulus and plastic section modulus.

5.2 Define shape factor. Derive shape factors for rectangular, circular and triangular section.

5.3 State the following theorems of plastic collapse: 1) Static theorem, 2) Kinematic theorem

5.4 What is plastic hinge and how does it differ from an ordinary hinge?

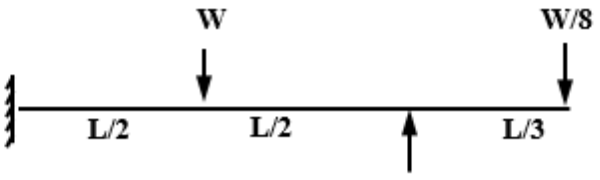
5.5 Determine the plastic moment capacity of ISMB 500 with top plate 300 mm x 20 mm.

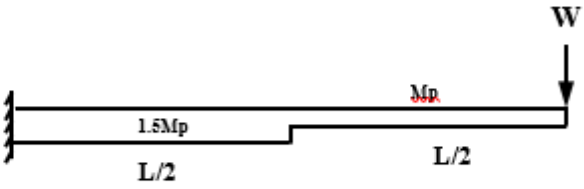
5.6 Find the shape factor for the following sections:

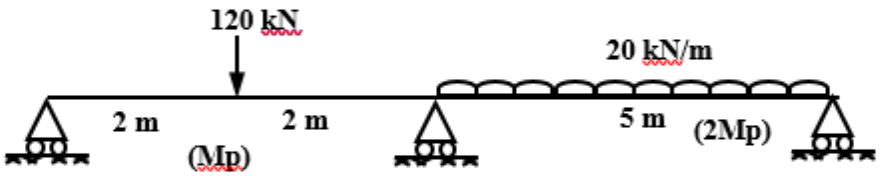
a) ISMC 400

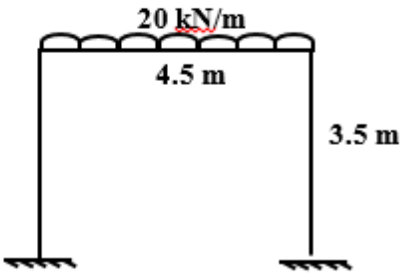
b) ISMB 300

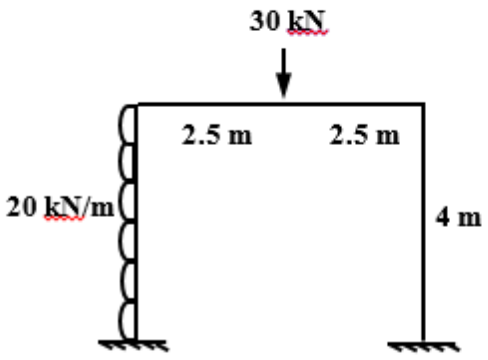
5.7 Find out the collapse load of the following beams and frames











5.8 A fixed beam of 6 m span carries a uniformly distributed load of 175 kN/m over the left half of the span. Determine the fully plastic moment for the beam. Also calculate plastic section modulus required fy=250 MPa.

5.9 Design a suitable section for a two span continuous beam, each having a span of 7.0 m and 8 m and supporting a dead load of 18 kN/m and live load of 14 kN/m by plastic design approach.