Channabasaveshwara Institute of Technology

(An ISO 9001:2015 Certified Institution)

NH 206 (B.H. Road), Gubbi, Tumkur – 572 216. Karnataka.

Department of Civil Engineering

Computer Aided Detailing of Structures

(18CVL76)

B.E – VII Semester

Name : _____

USN : _____

Batch : _____ Section : _____

B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VII
COMPUTER AIDED DETAILING OF STRUCTURES

Course Code	18CVL76	CIE Marks	40
Teaching Hours/Week(L:T:P)	(0:2:2)	SEE Marks	60
Credits	02	Exam Hours	03

Course Learning Objectives: This course will enable students to
1. Be aware of the Scale Factors, Sections of drawings,
2. Draft the detailing of RC and Steel Structural member.

Module -1 Detailing of RCC Structures
- Beams – Simply supported, Cantilever and Continuous.
- Slab – One way, Two way and One-way continuous.
- Staircase – Doglegged
- Cantilever Retaining wall
- Counter Fort Retaining wall
- Circular Water Tank, Rectangular Water Tank.

Module -2 Detailing of Steel Structures
1. Connections – Beam to beam, Beam to Column by Bolted and Welded Connections.
2. Built-up Columns with lacings and battens
3. Column bases and Gusseted bases with bolted and welded connections.
4. Roof Truss – Welded and Bolted
5. Welded Plate girder
6. Gantry Girder

Course outcomes: After studying this course, students will be able to:
- Prepare detailed working drawings

Question paper pattern:
1. Two questions shall be asked from each Module.
2. One full question should be answered from each Module.
3. Each question carries 50 marks.

Textbooks:
1. N Krishna Raju, "Structural Design and Drawing of Reinforced Concrete and Steel", University Press
2. Krishna Murthy, "Structural Design and Drawing – Concrete Structures", CBS Publishers, New Delhi

Reference Books:
1. SP 34: Handbook on Concrete Reinforcement and Detailing, Bureau of Indian Standards.
2. IS 13920, Ductile Design And Detailing Of Reinforced Concrete Structures Subjected To Seismic Forces - Code Of Practice, Bureau of Indian Standard.

Introduction

This practical detailing manual intends to outline practice of detailing of RCC and Steel drawings. Detailing of individuals members are included in the respective experiments. This manual includes certain aspects in detailing as per the codes which are common to all types of members so student should able to refer the IS codes (IS 456-200 & IS 800) for detailing and drawing the RCC and Steel connections by using AutoCAD Structural Detailing software, built on the familiar AutoCAD® platform, helps students to create more precise detailed drawings. AutoCAD Structural Detailing helps improve design accuracy by providing tools that automate the generation of more complete and comprehensive details and drawings. The software provides tools that help automate the creation of concrete reinforcement and steel connection.

INTRODUCTION TO RCC

The RCC is a composite material of construction. The combination of steel and concrete is effective and workable due the following reasons:

• The bond between concrete and steel is quite effective. Concrete grips the steel tightly while setting and hardening. Therefore, the transmission of force from concrete to the steel bars becomes possible and easy

• Both the materials are not chemically reactive with each other. The coating of cement grout on the surface of steel bars protects them from corrosion and does not produce any adverse chemical effect.

INTRODUCTION TO STEEL

The steel structures are constructed by properly connecting the available standard sections. The connections are an important part of steel structure and are designed more conventionally than any individual members. There is a discrepancy between the actual behavior and the analysis of steel structure is large, therefore the connections are complex to analyze and design. When the structural member fails in case of overloading then there is a general practice to prefer the individual member rather than the connections, therefore this kind of practice affects many structural members. The cost of structural steel consists of major portion of connections and that is the reason primary importance should be given to the design of connections for safety and economy of structure.

The AutoCAD software is launched by Autodesk. This software is mainly developed initially for the drawing as before 1995 the drawings was done manually using mini-drafter , therefore was very time consuming and making modifications was very difficult. It version version was developed in 1982 and was called Comdex.

In order to execute the drawings on the field, one must be able to read the drawings. AutoCAD makes it easier to draw and interpret the drawings. AutoCAD is a tool in which we can draw and modify any type of drawings using different commands such as line, rectangle, construction line etc. In AutoCAD we can do two dimensional as well as three dimensional drawings.

This AutoCAD tool is very user friendly because we can do modify very easily and copy the drawings 'n' number of times such that the original drawing can be retained as it is in the same working window , this helps in keeping both old and revised drawings.

The use of AutoCAD has spread widely all over the world because of its simple in user-friendly nature. AutoCAD has many versions such as AutoCAD 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007,2008,2009, 2010,2011,2014,2016, 2017 and the latest being 2019. The file format of AutoCAD is **.dwg**

APPLICATIONS OFAUTOCAD:

➢ AutoCAD improves the productivity of the designer to visualize the product and its component, parts and reduces the time required in synthesizing, analyzing and documenting the design.

➢ AutoCAD system permits a more detailed engineering analysis and a larger number of design alternatives can be investigated.

➢ The use of AutoCAD system provides better engineering drawings, more standardization in the drawing, and better documentation of the design, few drawing errors and legibility.

➢ AutoCAD serves as engineering drafting tool for designing various components, while minimizing human errors.

AutoCAD's innate features that enable its users to plan out architectural spaces, map them out and can be used simultaneously with 3D Max, Maya and other design/animation tools when the need arises. AutoCAD supports the use of DWG and DXF files which can be

exported from its interface to those of other advanced CAD applications to aid animation projects.

AUTOCAD vs MANUAL DRAWINGS:

1. AutoCAD is easier to understand and is user- friendly.

2. AutoCAD is much faster than manual drawings. Hence, its less time consuming.

3. It is more accurate, therefore, errors are reduced.

4. Creating backups easier, hence no problem of storage.

5. Etransmit option in AutoCAD, enables the user to transfer his/her document easily to the client in any part of the world.

6. Updation and modification is much easier.

Launching AutoCAD

Choose the AutoCAD icon from the desktop and double click.
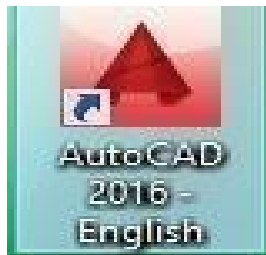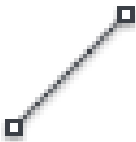

Graphical User Interface:
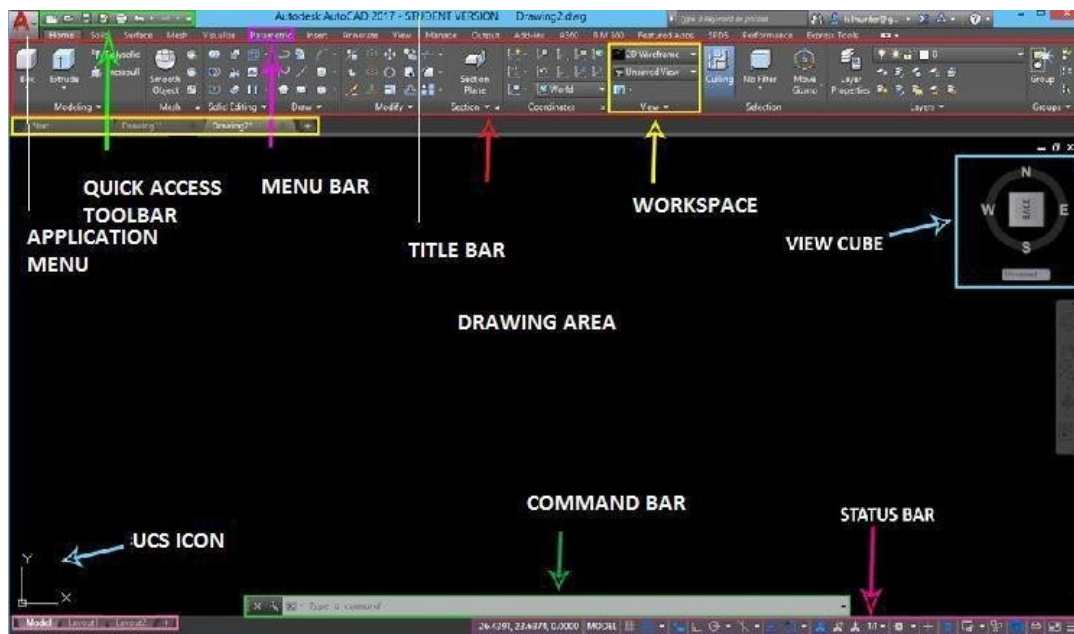
COORDINATE SYSTEM:-

When specifying positions you can use Cartesian or Polar Coordinates. Cartesian coordinates are simply a X value, a comma, and a Y value, for example: 100,100. Polar coordinates are a Distance followed by a < symbol and an angle, for example: 10<25. Angles are measured in degrees, with 0 = East and 90 = North. Any of these numbers can have decimal values.
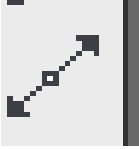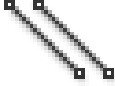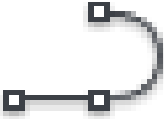
The Graphical User Interface (GUI) of AutoCAD contains the Quick Access Toolbar, Title Bar, Ribbon, Status Bar, UCS icon, application menu, workspace etc.
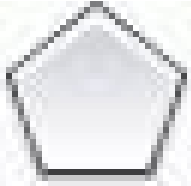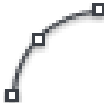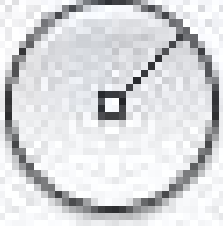
1. **Application Menu** The application menu contains basic commands pertaining to the drawing as a whole, such as Open, Save, Print, and Export.

2. **Quick Access Toolbar** is a customizable area of the interface where you can add your favorite or frequently used commands.

3. **Title bar** contains the title of the project and the version of AutoCAD used.

4. **Ribbon** is below the title bar. The menus and toolbars have been replaced with the ribbon, which helps you to find the commands quickly.

5. **Drawing Area** covers maximum space on the interface. All the drawings are drawn in this area.

6. **Command Bar** is a palette where you can type in commands and view history of the commands.

7. **View Cube** is in the upper right, from which you can change the view and UCS. Just below that is the NavBar that gives you controls for zooming, panning, orbiting, and more.

8. **UCS Icon** User Coordinate System is in the lower left hand corner which tell you the general orientation. UCS helps to orientate the drawing with respect to the current co-ordinate system and in particular, to know where the co-ordinate system origin is located.

9. **Status Bar** The Status bar displays some important details like the scheduling mode of new tasks (manual or automatic)
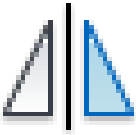
DRAWING TOOLS:	DESCRIPTION	OPTION
1. Open	Opens an existing file	Application menu Open
2. Units	Allows you to set the unit type (Architectural or Decimal), angle display format (degrees-minutes-seconds, or decimal degrees), and precision of the units,	Application menu Utilities Drawing setup
3. Limits	Changes the imaginary boundaries of the drawing, and controls whether drawing can be made outside of the boundaries. If Limit-checking is ON, drawing cannot be done outside of limits.	It sets lower left corner and upper right corner. Type limits on the command bar.
4. Dimension style	creates and modifies dimension styles	-----
5. Properties	Controls properties of existing object	Select the and right click, the various properties of the object will be displayed
6. Line	Used to draw straight line, between two specified points	➢ At command line just type L and press enter. ➢ On the ribbon click on the line icon. Any of the above options can be used to draw a line. AUTOCAD will ask you to specify the first point, click on a point and move the
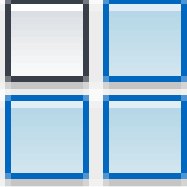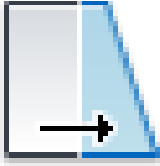
AUTOCAD TOOLS

		mouse. AutoCAD will now ask 'specify the next point or [undo]'. Respond by clicking at another point. AutoCAD will keep asking 'specify the next point or [undo]', until you finish the command by pressing Enter.
7. Construction line	Draws a line to full page at any angle.	➢ At command line just type CL and press enter or ➢ On the ribbon click on the construction line icon.
8. Multiline	Allows you to draw 1 to 6 lines parallel to each other, by specifying the distance between the lines.	➢ On command line type 'ml'
9. Poly-line	Creates a closed polyline of a boundary by picking an open area within an arcs or circles. area enclosed by lines, Unlike the standard line they can have width and they can follow curved path. To draw poly-line you need to give start and end point. Other options are to be selected only after the first point chosen.	H sets the half-width of the polyline segments ➢ U Undoes previous segment. ➢ W sets the width of poly-line segments.
10. Spline	Allows you draw a curve.	➢ On command line

	You need to specify the different points on the screen and curve passing through all the points will be drawn.	type spline.
11. Polygon	Draws regular polygons with a specified number of sides. Polygons are Polyline entities	➢ E Specifies size and rotation of polygon by picking endpoints of one edge. ➢ C Circumscribes polygon around a circle. ➢ I Inscribes polygon within a circle.
12. Arc	Draws an arc. The default method of drawing arcs is selecting three points (so-called "3 point arc"), which are the two endpoints of the arc and some other point along its locus. Other methods of drawing an arc can be specified by three letters, such as SEA, which means "Start Point, End Point, and included angle.	➢ A Included angle. ➢ C Center point of arc. ➢ D Direction angle of a line tangent to the arc. ➢ E Endpoint of arc ➢ L Length of chord passing through both endpoints of the arc R Radius, S Start point of arc
13. Circle	Draws a circle of any size. The default method is to pick a center point and pick a point on the radius or type the radius dimension, but other methods can be selected	➢ 2P Specifies circle by picking 2 points on the diameter. ➢ 3P Specifies circle by picking 3 points through which the circle will pass.

		➢ D Allows entering the diameter dimension instead of radius dimension ➢ TTR Specifies circle by picking two lines, arcs or circles for the circle to be tangent to, and entering the dimension of the radius ➢ <RET> Enters radius of circle (the default)
14. Rectangle	Draws a rectangle. You can select rectangle, AutoCAD will ask you to 'specify the first corner', click on a point. AutoCAD will ask you to 'specify the opposite corner', click on another point.	➢ 'A' on commandline will give you rectangle of specified area. AutoCAD will ask you to specify the area. When you enter area it will ask you specify the length. ➢ 'D' on commandline will give rectangle with specified dimensions. AutoCAD will ask you specify the length and then width.
15. Ellipses	This command is used to draw ellipse. The first two points of the ellipsedetermine	➢ C Allows specification of Center point of
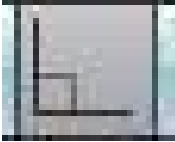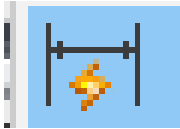
	the location and length of the first axis. The third point determines the distance between the center of the ellipse and the end point of the second axis.	ellipse rather than first axis endpoint ➢ R Allows specification of eccentricity rotation rather than length of second axis
MODIFYING TOOLS		
16. Erase	Erases selected entity from the drawing.	Type E on the keyboard and select the object you want to delete
17. Copy	Draws a copy of selected objects using two methods -- "base point" method, or "displacement" method.	M Allows multiple copies to be made of an object (in drawing which have similar object occurring many times such as doors window will have to be drawn a number of times, the COPY command can be used repeatable to save time.)
18. Mirror	Reflects or makes mirror image of existing or designated entities about a user-specified axis.	Type MI on the keyboard and select the object you want to mirror
19. Offset	Creates a new line, polyline, arc or circle parallel to the entity and at a specified distance from it.	<number> specifies offset distance T "Through" allows specification of a point through which the offset line, polyline, arc or circle is

		to pass
20. Array	Makes multiple copies of selected objects in a rectangular (parallel with the snap rotation) or circular pattern. Each resulting object can be manipulated independently.	The operation of array varies depending on type of array you choose. In rectangular pattern AutoCADasks for the number of rows (Horizontal) and columns(Vertical) to be constructed**.**
21. Move	Moves designated entities from their present location to another location without changing their size and orientation.	Type M on the keyboard and select the object you want to move
22. Rotate	Rotates the object around a central rotation point.	➢ Select the objects to rotate, then specify the base point about which the rotation is to occur ➢ Specify the angle through which the rotation shouldoccur
23. Stretch	Allows moving a portion of a drawing while retaining their connections to other parts of the drawing. You cannot stretch Blocks, Hatch patterns, or Text entities, however.	➢ Allows lengthening or shortens the object. ➢ Crossing window or polygon must cross the objects you want to stretch. ➢ Any object lies completely within the selection window is moved**.**
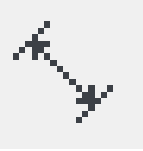
		You need to enter the base point and amount of stretch.
24. Trim	Erases a portion of selected entities crossing the "cutting edge" specified by you.	AutoCAD will ask you for cuttingedge. Once the cutting edge is selected it will ask you for object that you want to get rid off. Select the object you will get rid off it.
25. Extend	Extends the length of a line, arc, or polyline to meet a specified "boundary"	----
26. Break	Erases part of a line, arc or circle, or splits it into two lines or arcs	-----
27. Chamfer	Creates a chamfer (a angled line connection) at the intersection of two lines	D Sets chamfer distances P Chamfers an entire polyline
28. Fillet	Constructs an arc of specified radius between two lines, arcs, circles, or will create arcs of the specified radius at the vertices of a polyline. Radius of the arc to be constructed may be set to 0, which will make a sharp corner	P Fillets an entire Polyline at the vertices R Allows setting of the fillet radius. Default value is 0. Radius remains set until changed again
29. Explode	Separates a block, dimension or hatch pattern into its	-----

	constituent entities or makes a polyline into a series of straight lines	
30. Hatch	Fills an enclosed area or selected objects with a hatch pattern, solid fill, or gradient fill.	<pattern-name> uses hatch pattern name from library file to fill designated area with a pseudo- block hatch entity -- can be reduced to individual lines and points by Exploding it.
31. Osnap	Enables points to be precisely located on reference points of existing objects. This is the so-called "Running Mode" of OSNAP, which sets selection method to run continuously until set to NONE (none) or until overridden by selecting another "Interrupt Mode" OSNAP method from the cursor menu. Combinations of OSNAP methods can be used by selecting a series of options separated by commas. For instance, if you want ot always pick either endpoints or intersection points when locating endpoints of lines, you would issue the command as follows: OSNAP <RET> END,INT <RET>	can be transparent CEN Centre of arc or circle END closest Endpoint of arc or line INS Insertion point of Text or Block INT Intersection of line, arc, or circle MID Midpoint of line, arc, rectangle side, or polygon side NEA Nearest point selected by aperture on line, polyline, arc, or circle NOD Node (another name for a Point) NON None -- used when a "Running OSNAP" is on to temporarily turn off OSNAP selection PER Perpendicular point to line, arc or circle -- when used with an arc or circle it will draw a line to the

		surface of the arc or circle heading toward the center point QUA Quadrant point of arc or circle (top, bottom, right or left side) QUI Quick mode -- this is a modifier to one of the other OSNAP options -- it will find the first point that meets the requirements, not necessarily the closest point to the aperture. TAN Tangent point to arc or circle
32. Ortho	Constrains drawing so that only lines aligned with the grid can be drawn, usually means only horizontal or vertical lines, however, if the crosshairs are rotated through the "Snap" "Rotate" command sequence, the lines drawn are constrained to being parallel with the crosshair rotation. Constraint can be overridden by snapping to a point or by entering exact coordinates for endpoints	-----
33. Measure	Places points (or, optionally, Blocks) at intervals along a selected line, polyline, arc or circle. The interval distanceis given by the user. If points	B specifies that a defined Block is to be used as a marker instead of a point.

	are used as the marker to be placed along the entity, they are not visible unless the Point type is set to type 3 with the PDMODE command.	
34. Scale	Alters the size of existing objects	R Resizes with respect to a reference size
35. Text	Draws text characters of any size with selected styles	➢ Text is very important in precision drawings such as those produced by AUTOCAD. Text is an object on drawing, just like line or circle. This is open to same editing commands likescale, move and erase. AutoCAD gives you two options ➢ Single line. Multiline
36. Leader	Draws a line or series of lines with an arrow head (commonly called a "leader") to point to an object to notate it. This command will also prompt you for the note at the end of the leader line, but it will allow only one line of text. The most useful method	➢ -------

	of using this command is to simply draw leaders between the object to be notated and text that you create with the DTEXT command	
37. Linear dimension	Draws the dimension of a line linearly	-------
38. Aligned dimension	Draws a linear dimension with the dimension line parallel to the selected dimension origin points. This lets you align a dimension with an angled line that is not either exactly horizontal or vertical	-------
39. Angular	Draws an arc and calculates the angle between two non-parallel lines, and draws the text and arrowheads. Arrowheads are the standard AutoCAD filled triangles, regardless of your defined Arrow Block	-------
40. Base-line dimension	Continues a linear dimension from the baseline (the so-called "first extension line") of the previous or selected dimension. This is not frequently used in architectural dimensions	-------
41. Centre	Draws a pair of crossed lines at the center of a circle or arc	-------

	on the current layer	
42. Diameter	Draws a dimension through the center of a circle or arc, calculating the diameter, with one of the arrow heads located at the point on the circle or arc which is picked	-------
43. Radius	Draws the radius dimension of an arc or circle from the center to the point on its locus where the arc or circle was selected.	-------

Sl.no	FUNCTION KEY	COMMAND
1.	F1	Online Help
2.	F3	Osnap ON/OFF
3.	F6	Coords On/Off
4.	F7	Grid On/Off
5.	F8	Ortho On/Off
6.	F9	Snap On/Off
7.	F11	Object Snap Tracking ON/OFF
8.	Press CTRL + C	To COPYCLIP
9.	Press CTRL + V	To PASTE CLIP
10.	Press CTRL + G	To turn GRID on/off
11	Press CTRL + N	To create a NEW drawing
12.	Press CTRL + O	To OPEN an existing drawing.
13.	Press CTRL + P	to PLOT a drawing
14.	Press CTRL + S	To save a drawing.
15.	Press CTRL + X	To cut to Clipboard.
16.	Press CTRL + Z	To UNDO
17.	Press CTRL + A	To select all

Function and Accelerator Keys

Sl.no	COMMAND	SHORT CUT
1.	Line	L
2.	Multiline	ml
3.	Poly line	pl
4.	3D Poly line	3d poly
5.	Polygon	pol
6.	Rectangle	Rec
7.	Arc	a
8.	Circle	c
9.	Donut	do
10.	Spline	spl
11	Ellipse	El
12.	Block	b
13.	Write block	w
14.	Insert	I
15.	Hatch	H
16.	Text	T
17.	Dimension	Dim

AutoCAD short cuts
DRAWING COMMANDS
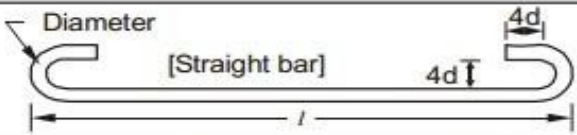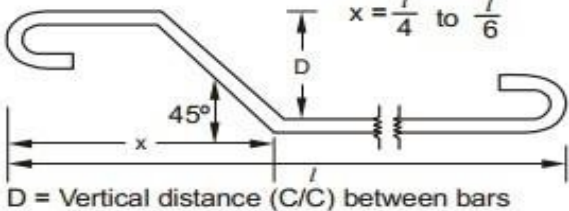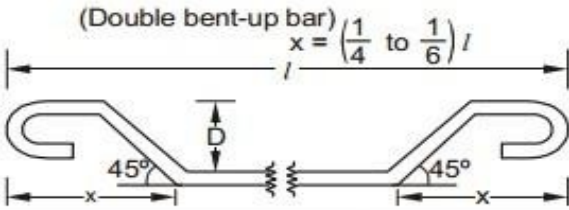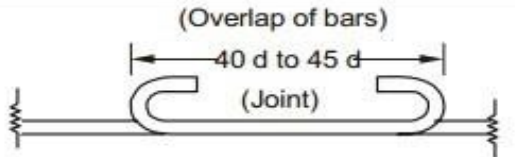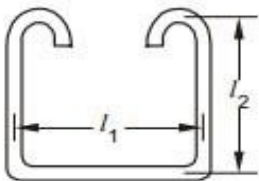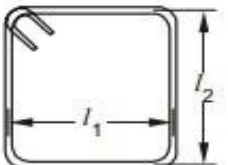
Sl. No.	Details of Bar Shape	Length of Hooks	Total Length of Bar
1.	Diameter [Straight bar] 4d 4d l	2[9d] = 18 d (both hooks together)	[l + 18 d]
2.	[Bent-up at one end only]] $x = \frac{l}{4}$ to $\frac{l}{6}$ D 45° x l D = Vertical distance (C/C) between bars	2[9d] = 18d (both hooks together)	[l + 18 d + 0.42 D]
3.	(Double bent-up bar) $x = \left(\frac{1}{4}\right.$ to $\left.\frac{1}{6}\right) l$ l D 45° 45° x x	2[9d] = 18d (as for above cases)	[l + 18 d + 2 × 0.42 D]
4.	(Overlap of bars) 40 d to 45 d (Joint)	2[9d] = 18d	Overlap length at joint = [(40 d to 45 d) + 18 d]
5.	l_2 l_1	[Here, one hooks height = 14d] 2 × (14d) = 28 d	[l_1 + 2l_2 + 28 d]
6.	l_2 l_1	2(12d) = 24 d	[2(l_1 + l_2) + 24 d]

Table no.1. Formula for bent up bars

Module 1

Detailing of RCC Structures
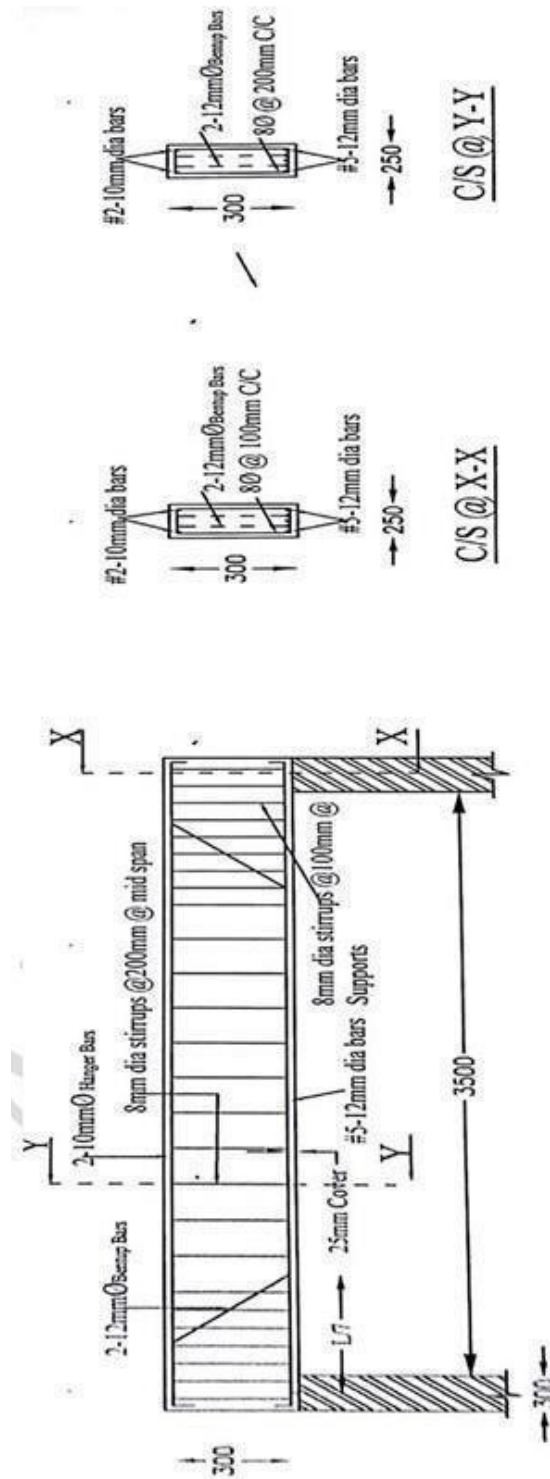
Fig.1. Simply supported beam

EXPT No: 01   **DATE:**
SIMPLY SUPPORTED BEAM

Aim: To draw the reinforcement detailing of simply supported beam using Auto CAD software for given data.

Problem:

The following are the particulars of a simply

supported beam. Clear span - 3500 mm

Width of supports 300 mm Size

of beams - 250 x 300 mm

Clear cover to steel rods - 25 mm

Main reinforcement (tensile) – 5-12

ϕ mm Fe 415 steel Hanger rods - 2-

10 ϕ mm Fe4l5steel

Bent up bars – 2- 12 ϕ mm

Shear reinforcement - Two legged stirrups 8 ϕ mm @ 200 mm.

Procedure:

- The limits are set before starting the drawing. The lower left corner is set as default (0.0000, 0.0000). The upper right corner is changed as per our requirements.
- By using units command, we set the types as decimal, precision as 0.0000 and units to scale as millimeters.
- Ortho is switched off as the drawing requires use of inclined line also along with horizontal and vertical lines.
- By using the line command, the outline of the required drawing is drawn.
- By using the trim command, the extra lines are trimmed.
- Lines are extended using extend command wherever necessary.
- Donut option is used to represent the c/s of reinforcements.
- Offset command is used to get lines at regular distance.
- Hatching is done using hatch command.
- Dimensions are provided and text command is also used for labeling the drawing.

Draw the following views to a suitable scale.

Longitudinal section of the beam showing

reinforcement details. Cross sectional view of

the beam at mid span and at supports.

Result: The required reinforcement detailing of simply supported beam using AutoCAD software
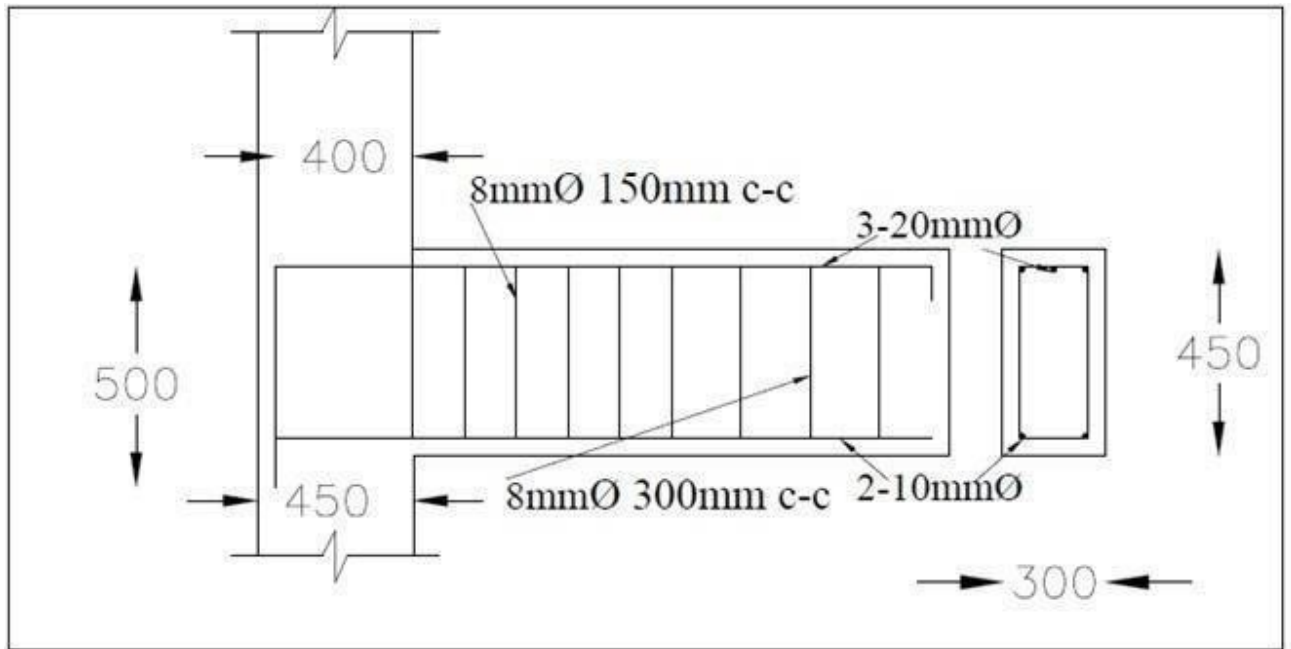
Fig.2. Cantilever beam

All dimensions are in mm

EXPT No:02 **DATE:**

CANTILEVER BEAM

Aim: To draw the reinforcement detailing of cantilever beam using Auto CAD software for given data.

Problem:

The following are the particulars of a cantilever beam. Clear span – 1500 mm
Width of supports - 300 mm Size of
beams - 300 x 450 mm
Clear cover to steel rods - 25 mm
Main reinforcement (tensile) – 3-20 ϕ mm Fe 415 steel @ top
Hanger rods - 2-10 ϕ mm Fe4l5steel @ bottom
Anchorage length – 900 mm
Shear reinforcement - Two legged stirrups 8 ϕ mm @ 300 mm.

Procedure:

- The limits are set before starting the drawing. The lower left corner is set as default (0.0000, 0.0000). The upper right corner is changed as per our requirements.
- By using units command, we set the types as decimal, precision as 0.0000 and units to scale as millimeters.
- Ortho is switched off as the drawing requires use of inclined line also along with horizontal and vertical lines.
- By using the line command, the outline of the required drawing is drawn.
- By using the trim command, the extra lines are trimmed.
- Lines are extended using extend command wherever necessary.
- Donut option is used to represent the c/s of reinforcements.
- Offset command is used to get lines at regular distance.
- Hatching is done using hatch command.
- Dimensions are provided and text command is also used for labeling the drawing.

Draw the following views to a suitable scale.

Longitudinal section of the beam showing
reinforcement details. Cross sectional view of
the beam at supports.

Result: The required reinforcement detailing of cantilever beam using Auto CAD software

Fig.3. Continuous beam

All dimensions are in mm

EXPT No: 03   DATE:

CONTINUOUS BEAM

Aim: To draw the reinforcement detailing of continuous beam using Auto CAD software for given data.

Problem:
> The following are the particulars of a
> continuous beam. Clear span – 3000 mm
> Width of supports - 300 mm Size of beams - 200 x 300 mm
> Clear cover to steel rods - 25 mm
> Main reinforcement (tensile) – 4-12 ϕ mm Fe 415 steel @ bottom
> Hanger rods - 2-10 ϕ mm Fe 4l5steel @ top
> Bent up bars – 2- 12 ϕ mm
> Shear reinforcement - Two legged stirrups 8 ϕ mm @ 300 mm.

Procedure:

- The limits are set before starting the drawing. The lower left corner is set as default (0.0000, 0.0000). The upper right corner is changed as per our requirements.
- By using units command, we set the types as decimal, precision as 0.0000 and units to scale as millimeters.
- Ortho is switched off as the drawing requires use of inclined line also along with horizontal and vertical lines.
- By using the line command, the outline of the required drawing is drawn.
- By using the trim command, the extra lines are trimmed.
- Lines are extended using extend command wherever necessary.
- Donut option is used to represent the c/s of reinforcements.
- Offset command is used to get lines at regular distance.
- Hatching is done using hatch command.
- Dimensions are provided and text command is also used for labeling the drawing.

Draw the following views to a suitable scale.
> Longitudinal section of the beam showing
> reinforcement details. Cross sectional view of
> the beam at supports and mid span.

Result: The required reinforcement detailing of continuous beam using Auto CAD software
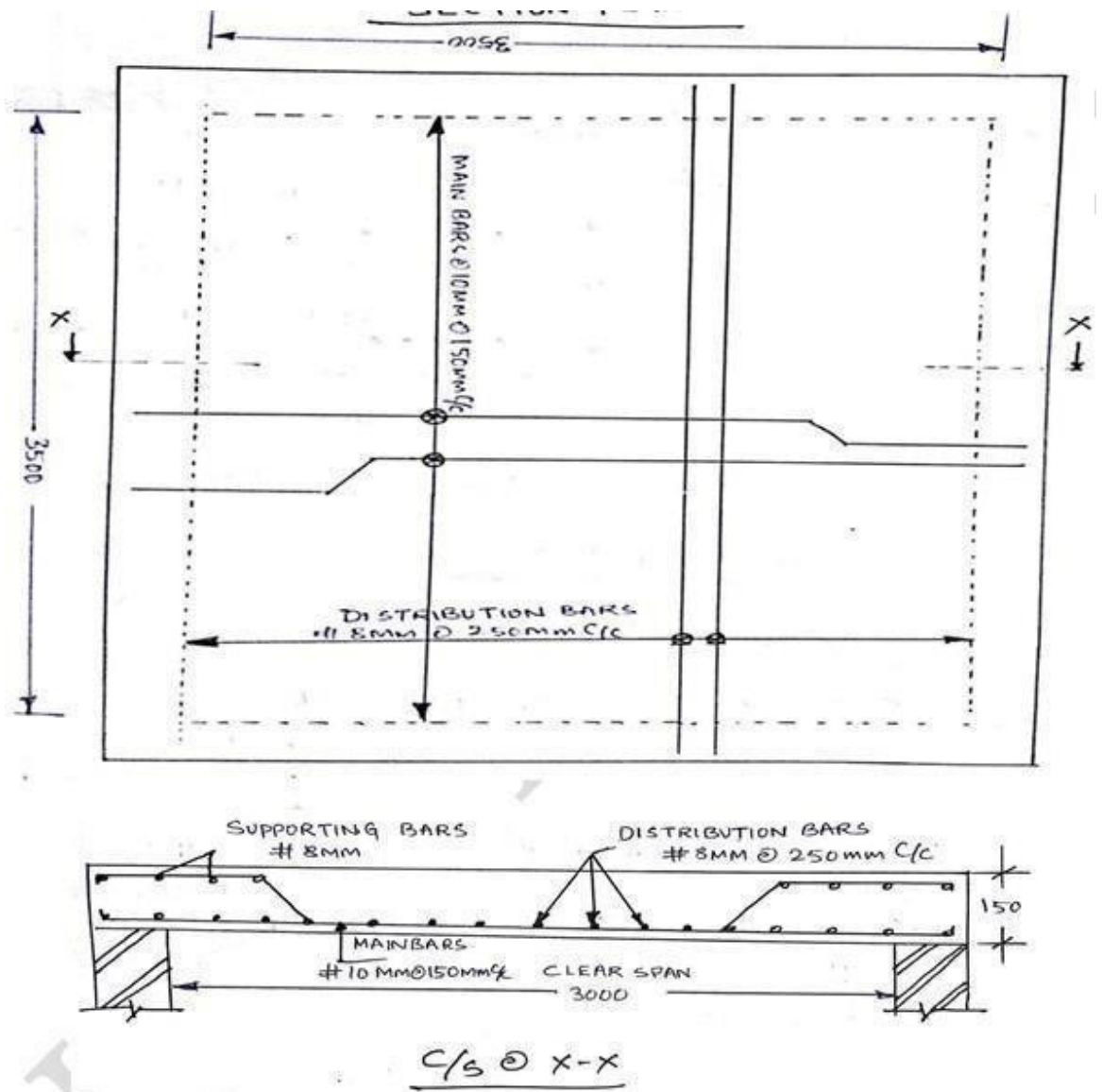
Fig.4. one way slab

All dimensions are in mm

$$L_d = \frac{\phi \, \sigma_s}{4 \, \tau_{bd}} =$$

470mm

EXPT No: 04   **DATE:**

ONE WAY ROOF SLAB

Aim: To draw the reinforcement detailing of one way roof slab using AutoCAD software for given data.

Problem:

The following are the particulars of a one
way roof slab Clear span – 3500mm
Width of supported walls - 230mm
Total thickness of slab - 160mm
Clean cover - 15mm
Main reinforcement – 10 ϕ mm Fe 415 steel rods@ 150 mm c/c
Distributors – 8 ϕ mm Fe 415 steel rods @ 260mm c/c
Anchorage and curtailment of reinforcement may be adopted with standard values
and any more data required may be assumed suitably

Procedure:

- The limits are set before starting the drawing. The lower left corner is set as default (0.0000, 0.0000). The upper right corner is changed as per our requirements.
- By using units command, we set the types as decimal, precision as 0.0000 and units to scale as millimeters.
- Ortho is switched off as the drawing requires use of inclined line also along with horizontal and vertical lines.
- By using the line command, the outline of the required drawing is drawn.
- By using the trim command, the extra lines are trimmed.
- Lines are extended using extend command wherever necessary.
- Donut option is used to represent the c/s of reinforcements.
- Offset command is used to get lines at regular distance.
- Hatching is done using hatch command.
- Dimensions are provided and text command is also used for labeling the drawing.

Draw the following views to a suitable scale

Cross section of the slab showing
reinforcement details Plan at bottom
showing

Result: The required reinforcement detailing of one way roof slab using Auto CAD software

Fig.5. Two way slab

All dimensions are in mm

$$L_d = \frac{\phi\,\sigma_s}{4\,\tau_{bd}} \quad 470mm$$

EXPT No: 05   **DATE:**

TWO WAY ROOF SLAB

Aim: To draw the reinforcement detailing of two way roof slab using Auto CAD software for given data.

Problem:

The following are the particulars of a two
way roof slab Clear span – 3000mm
Width of supported walls - 230mm
Total thickness of slab - 150mm
Clean cover - 15mm
Main reinforcement – 12 ϕ mm Fe 415 steel rods@ 150 mm c/c
Distributors – 12 ϕ mm Fe 415 steel rods @ 150mm c/c
Anchorage and curtailment of reinforcement may be adopted with standard values
and any more data required may be assumed suitably

Procedure:

- The limits are set before starting the drawing. The lower left corner is set as default (0.0000, 0.0000). The upper right corner is changed as per our requirements.
- By using units command, we set the types as decimal, precision as 0.0000 and units to scale as millimeters.
- Ortho is switched off as the drawing requires use of inclined line also along with horizontal and vertical lines.
- By using the line command, the outline of the required drawing is drawn.
- By using the trim command, the extra lines are trimmed.
- Lines are extended using extend command wherever necessary.
- Donut option is used to represent the c/s of reinforcements.
- Offset command is used to get lines at regular distance.
- Hatching is done using hatch command.
- Dimensions are provided and text command is also used for labeling the drawing.

Draw the following views to a suitable scale
Cross section of the slab showing
reinforcement details Plan at
bottom showing

Result: The required reinforcement detailing of two way roof slab using Auto CAD software

Fig.7. one way continuous slab C/S
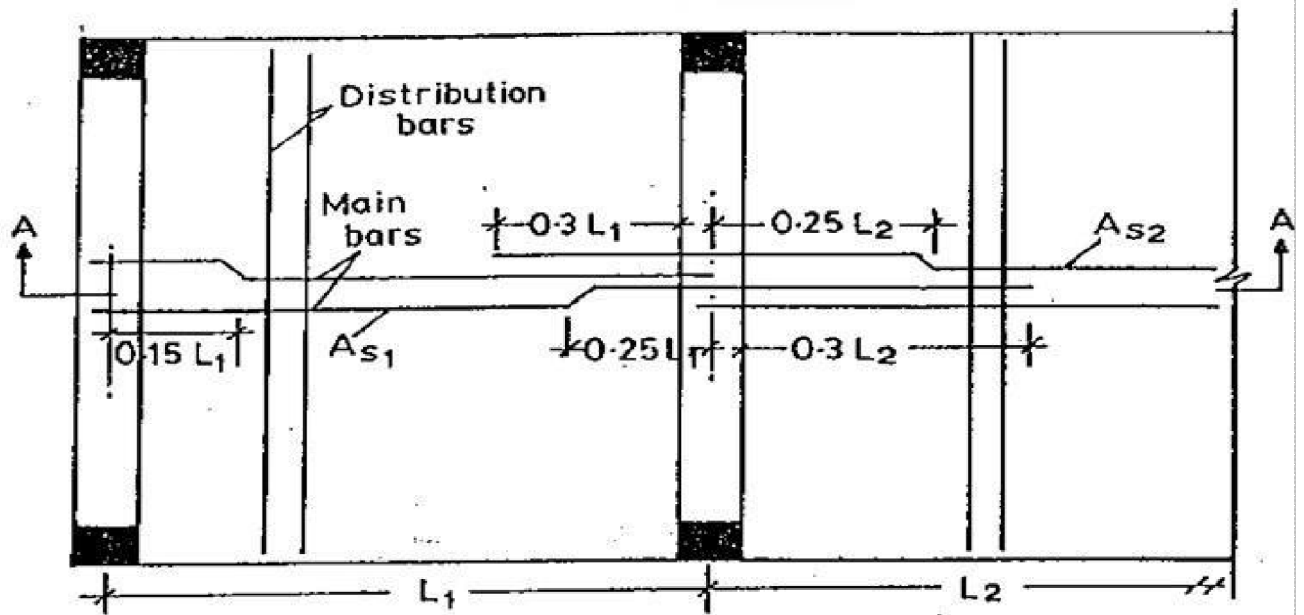
Fig.7.Plan at bottom showing

All dimensions are in mm

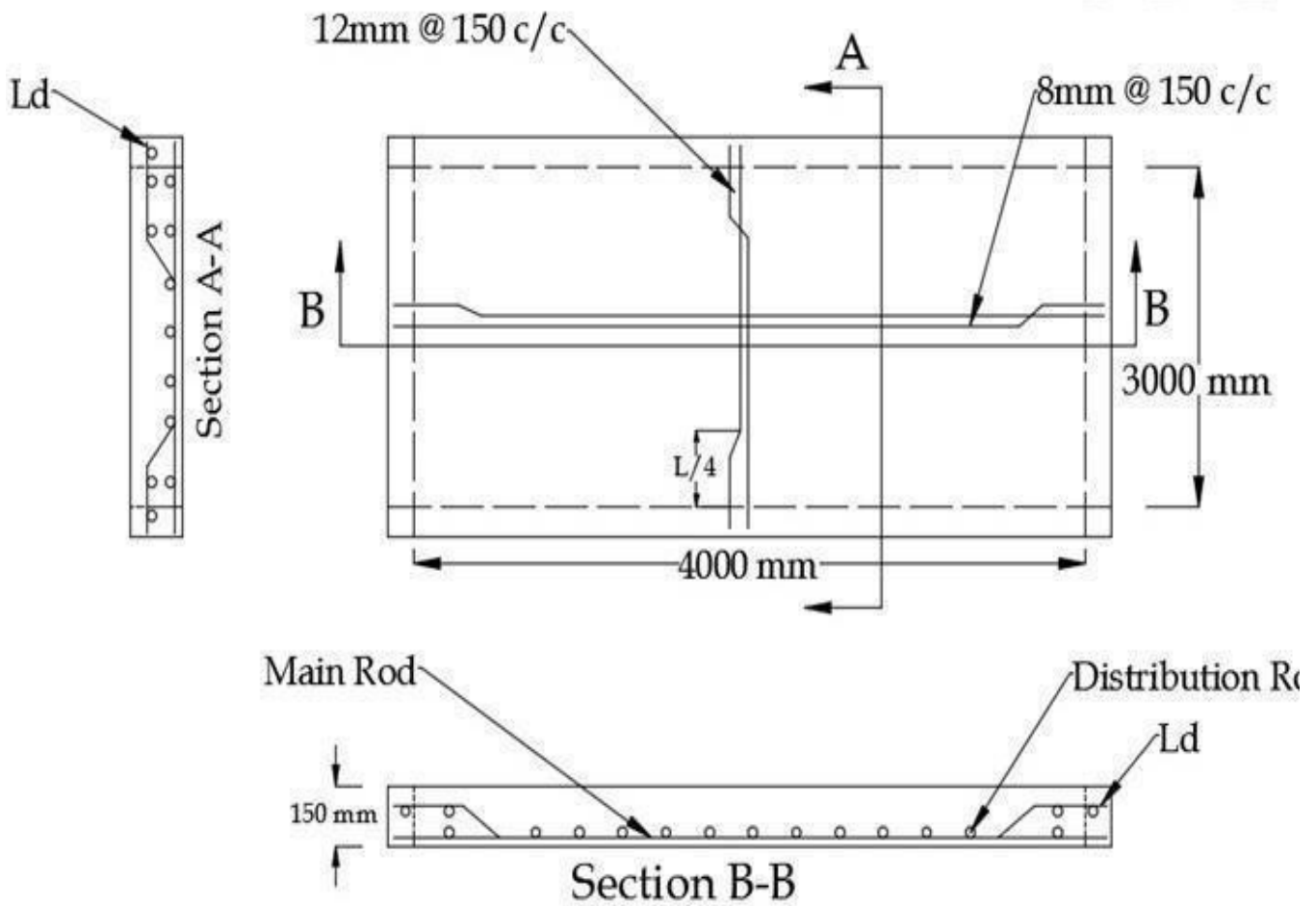**EXPT No: 06**   **DATE:**

ONE WAY CONTINUOUS ROOF SLAB

Aim: To draw the reinforcement detailing of one way continuous roof slab using Auto CAD software for given data.

Problem:

     The following are the particulars of a one way
continuous roof slab Clear span – 3700mm
Width of supported walls - 300mm Total thickness of slab - 160mm Clean cover - 15mm
Main reinforcement – 10 ϕ mm Fe 415 steel rods@ 150 mm c/c @supports
and @ mid span(+ve) Distributors – 10 ϕ mm Fe 415 steel rods @ 300mm c/c
Anchorage and curtailment of reinforcement may be adopted with standard values
and any more data required may be assumed suitably

Procedure:

- The limits are set before starting the drawing. The lower left corner is set as default (0.0000, 0.0000). The upper right corner is changed as per our requirements.
- By using units command, we set the types as decimal, precision as 0.0000 and units to scale as millimeters.
- Ortho is switched off as the drawing requires use of inclined line also along with horizontal and vertical lines.
- By using the line command, the outline of the required drawing is drawn.
- By using the trim command, the extra lines are trimmed.
- Lines are extended using extend command wherever necessary.
- Donut option is used to represent the c/s of reinforcements.
- Offset command is used to get lines at regular distance.
- Hatching is done using hatch command.
- Dimensions are provided and text command is also used for labeling the drawing.

Draw the following views to a suitable scale

     Cross section of the slab showing
reinforcement details Plan at
bottom showing

Result: The required reinforcement detailing of one way continuous roof slab using Auto CAD software

Fig.8. Plan and Section

All dimensions are in mm

EXPT No: 07   **DATE:**

DOG LEGGED STAIRCASE

Aim: To draw the reinforcement detailing of dog legged staircase using Auto CAD software for given data.

Problem

The following are the particulars of a
dog legged staircase. Clear size of
staircase room - 5.9 m x 3.4 m
Width of supporting walls - 230 mm Vertical distance between the floors -
3.3 m Width of flight - 1600mm
Width of landing - 1600 mm
Number of flights – 2, No. of riser in each flight – 11, No. of
treads in each flight - 10 Rise - 150 mm, Tread - 270 mm
Thickness of waist slab - 250 mm
Main reinforcement 10 mm Fe 415 steel @ 120 mm c/c
Distributors - 8mm Fe 415 steel @ 160 mm c/c, 50% of the main
reinforcement are provided at the bottom of landing slab

Procedure:

- The limits are set before starting the drawing. The lower left corner is set as default (0.0000, 0.0000). The upper right corner is changed as per our requirements.
- By using units command, we set the types as decimal, precision as 0.0000 and units to scale as millimeters.
- Ortho is switched off as the drawing requires use of inclined line also along with horizontal and vertical lines.
- By using the line command, the outline of the required drawing is drawn.
- By using the trim command, the extra lines are trimmed.
- Lines are extended using extend command wherever necessary.
- Donut option is used to represent the c/s of reinforcements.
- Offset command is used to get lines at regular distance.
- Hatching is done using hatch command.
- Dimensions are provided and text command is also used for labeling the drawing.

Draw the following views to a suitable scale

Cross section of the slab
showing reinforcement details
Plan at bottom showing

Result: The required reinforcement detailing of dog legged staircase using Auto CAD software
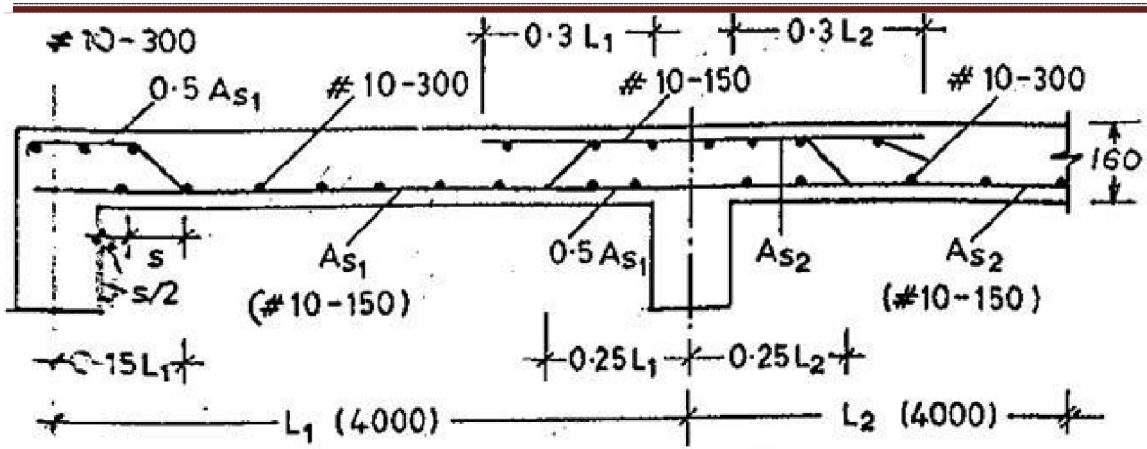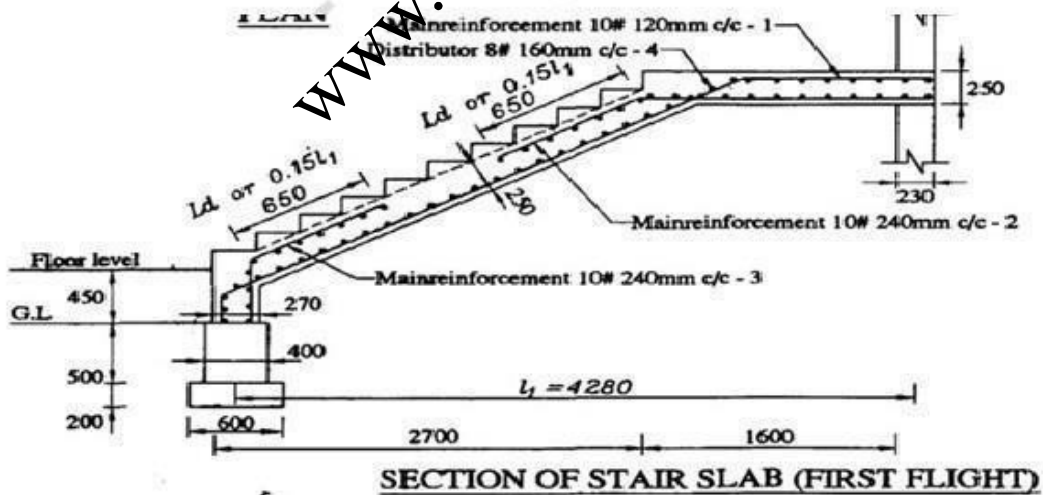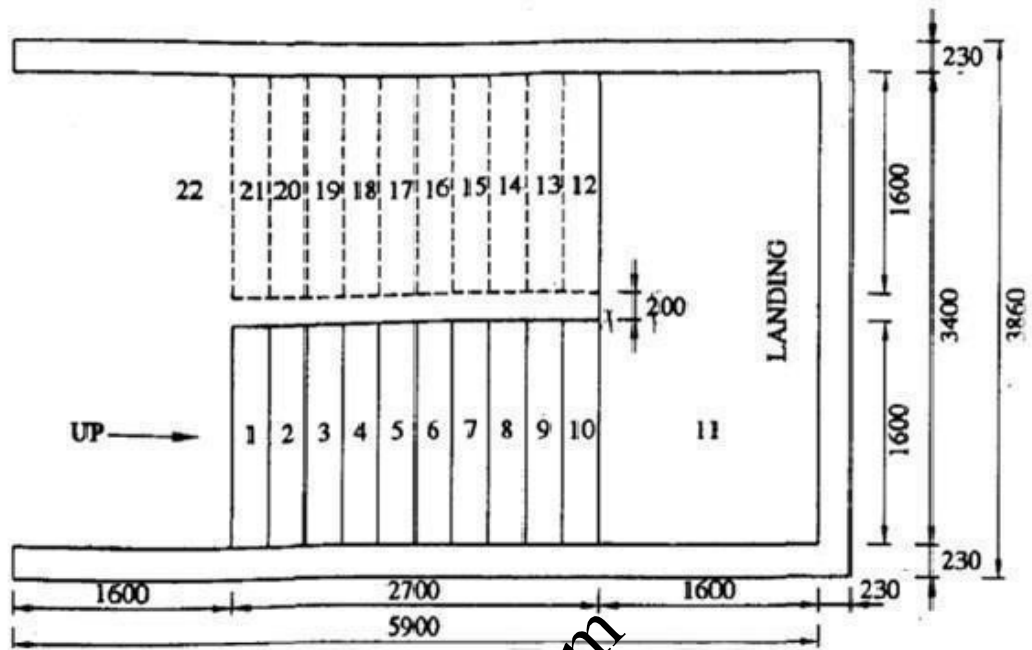
Fig.10. Cross section of cantilever retaining wall

All dimensions are in mm

EXPT No: 08   **DATE:**

CANTILEVER RETAINING WALL

Aim: To draw the reinforcement detailing of cantilever retaining wall using Auto CAD software for given data.

Problem

The following are the particulars of a cantilever retaining wall

Height of earth embankment	- 3.0 m (above GL)
Minimum depth of foundation	- 1.75 m
Total Height of retaining wall	- 4.75 m
Toe projection	-1.0 m
Thickness of base slab	- 0.45 m
Top & bottom width of stem	-0.2 m & 0.4 m
Reinforcement for stem	

Main bars 16 ϕ mm @ 300 mm c/c Distribution bars- 12 ϕ mm @ 200 mm c/cReinforcement for toe & heelMain bars for toe 12 ϕ mm @ 200 mm c/c for both direction Main bars for heel 12 ϕ mm @ 200 mm c/c for both direction

Procedure:

- The limits are set before starting the drawing. The lower left corner is set as default (0.0000, 0.0000). The upper right corner is changed as per our requirements.
- By using units command, we set the types as decimal, precision as 0.0000 and units to scale as millimeters.
- Ortho is switched off as the drawing requires use of inclined line also along with horizontal and vertical lines.
- By using the line command, the outline of the required drawing is drawn.
- By using the trim command, the extra lines aretrimmed.
- Lines are extended using extend command wherever necessary.
- Donut option is used to represent the c/s of reinforcements.
- Offset command is used to get lines at regular distance.
- Hatching is done using hatch command.
- Dimensions are provided and text command is also used for labeling the drawing.

Draw the following views to a suitable scale

Cross section and longitudinal section of cantilever retaining wall showing reinforcement details

Result: The required reinforcement detailing of counterfort using Auto CAD software
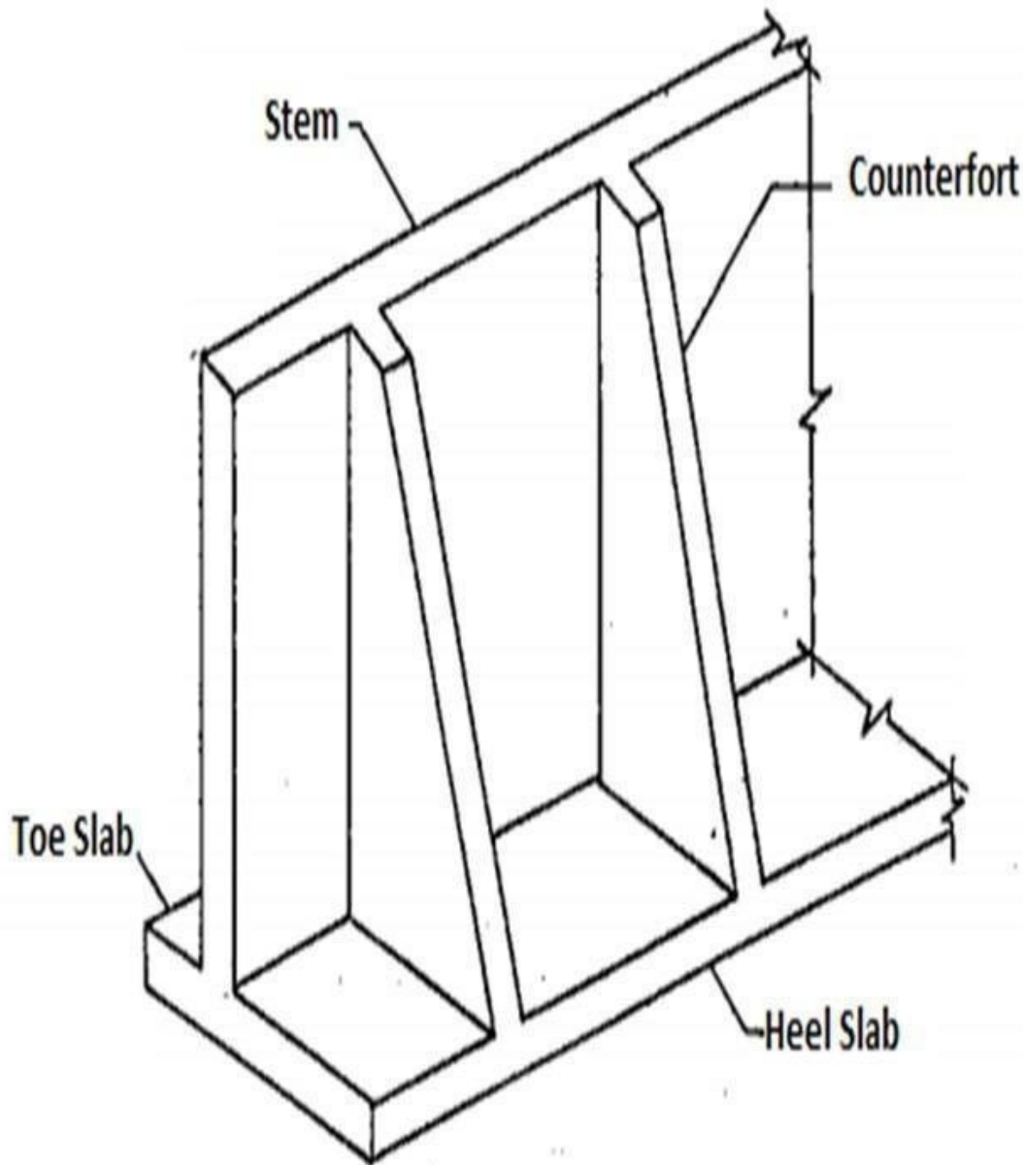
Fig.12. Counterfort retaing wall

EXPT No: 09   **DATE:**

COUNTERFORT RETAINING WALL

Aim: To draw the reinforcement detailing of counterfort retaining wall using Auto CAD software for given data.

Problem

The following are the particulars of a of counterfort
retaining wall Height of earth embankment   -
5.5 m (above GL) Base width 4m
Minimum depth of foundation   - 1.3 m spacing of
counterforts 3 m c/c Total Height of retaining wall- 6.8 m

Toe projection	-0.8 m
Thickness of base slab	- 0.3 m
Top & bottom width of stem	-0.2 m & 0.4 m

Reinforcement for stem-Main bars 12 ϕ mm @ 225 mm c/c Distribution bars- 12 ϕ mm @ 300 mm c/c

Reinforcement for toe & heel-Main bars for toe 16 ϕ mm @ 220 mm c/c for both direction Main bars for heel 16 ϕ mm @ 180 mm c/c for both direction Distribution bars -12 ϕ mm @ 225 mm c/c for both toe and heel

Procedure:

- The limits are set before starting the drawing. The lower left corner is set as default (0.0000, 0.0000). The upper right corner is changed as per our requirements.
- By using units command, we set the types as decimal, precision as 0.0000 and units to scale as millimeters.
- Ortho is switched off as the drawing requires use of inclined line also along with horizontal and vertical lines.
- By using the line command, the outline of the required drawing is drawn.
- By using the trim command, the extra lines are trimmed.
- Lines are extended using extend command wherever necessary.
- Donut option is used to represent the c/s of reinforcements.
- Offset command is used to get lines at regular distance.
- Hatching is done using hatch command.
- Dimensions are provided and text command is also used for labeling the drawing.

Draw the following views to a suitable scale

Cross section and longitudinal section of counterfort retaining wall showing reinforcement details

**Result:** The required reinforcement detailing of counterfort retaining wall using Auto CAD software
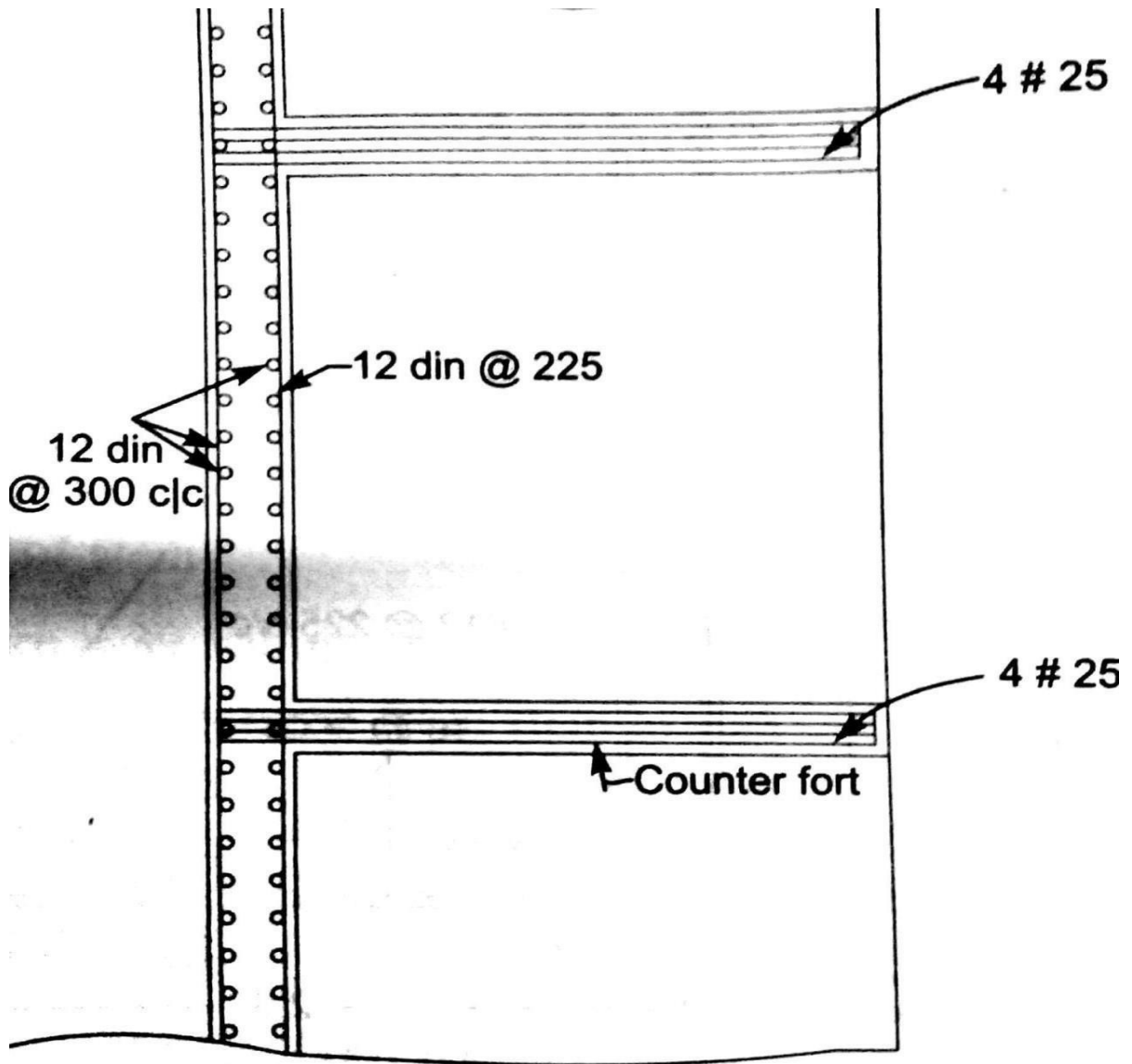
(c) Reinforcement in stem and counterfort (plan view)

(a) Section near counterfort
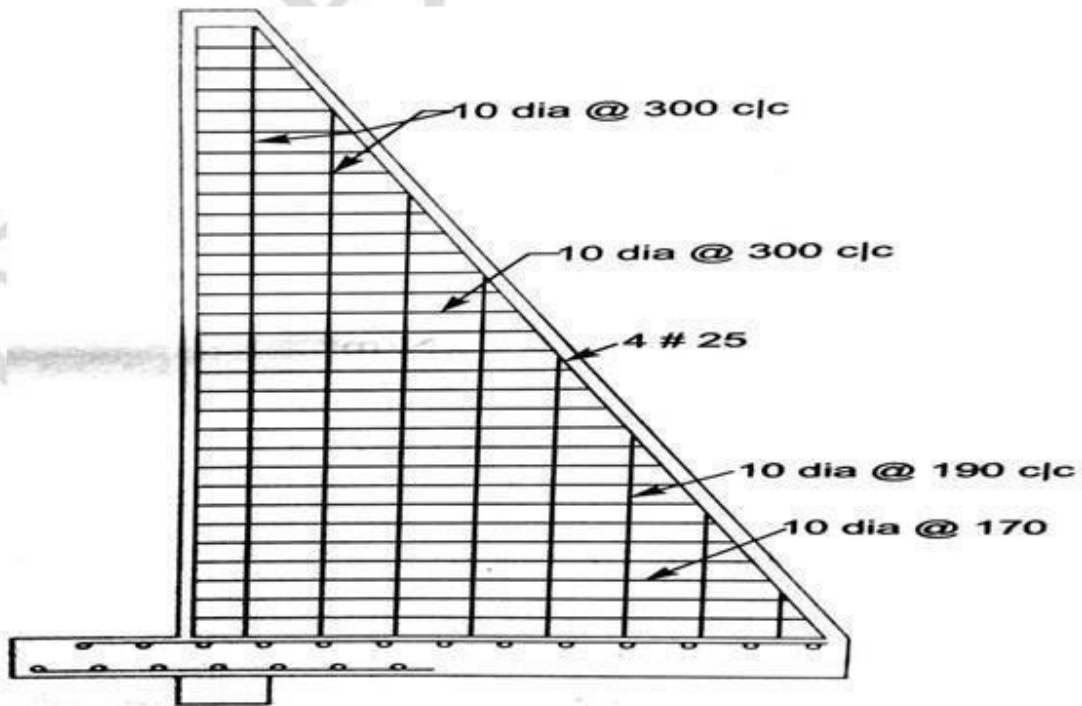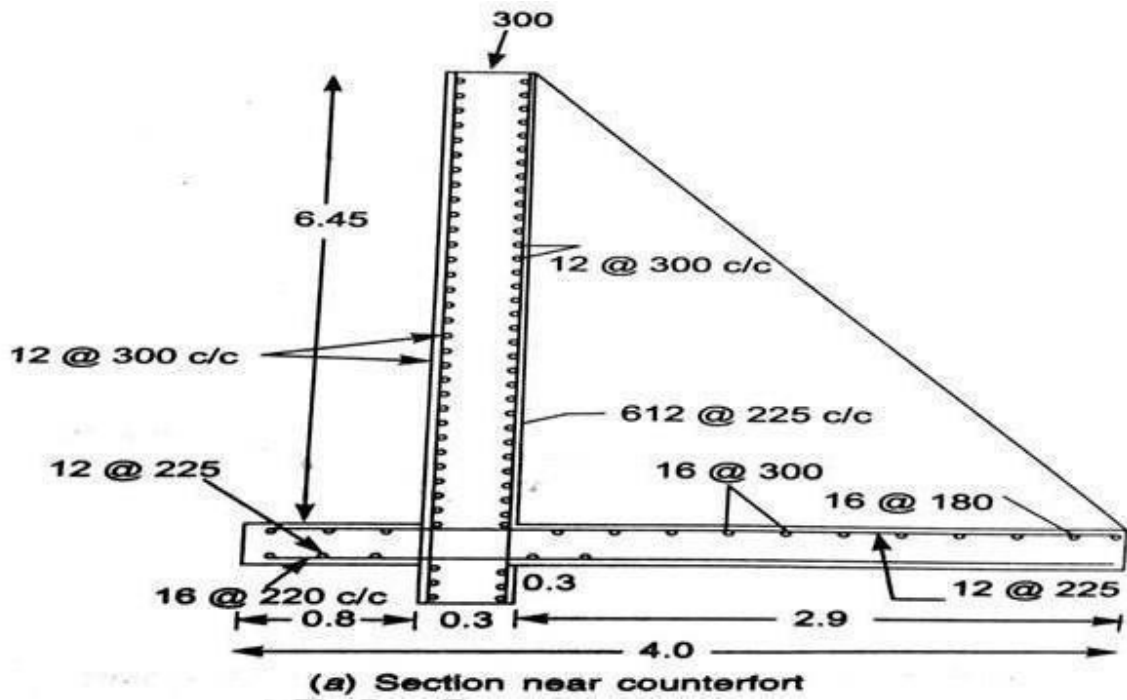
Fig.11. Cross section through counterfort

Fig.13. Circular water tank

EXPT No: 10

DATE:

CIRCULAR WATER TANK

Aim: To draw the reinforcement detailing of circular water tank using Auto CAD software for given data.

Problem

The following are the particulars of a of circular water tank

Capacity of tank	– 50,000 liters-(m^3)		
Depth of tank	– 4m	Thickness of wall	– 0.17 m
Freeboard	– 0.2 m	Thickness of base slab	- 0.15 m

Total height of tank - 4.2 m Diameter of tank – 11.3 m

Hoop steel - provide 12 ϕ mm @ 130 mm c/c (increase 50 mm spacing @ every 1mheight)

Vertical Distribution bars -10 ϕ mm @ 160 mm c/c

Base slab reinforcement in the form of mesh - 10 ϕ mm @ 170 mm c/c @ top and bottom

Procedure:

- The limits are set before starting the drawing. The lower left corner is set as default (0.0000, 0.0000). The upper right corner is changed as per our requirements.
- By using units command, we set the types as decimal, precision as 0.0000 and units to scale as millimeters.
- Ortho is switched off as the drawing requires use of inclined line also along with horizontal and vertical lines.
- By using the line command, the outline of the required drawing is drawn.
- By using the trim command, the extra lines are trimmed.
- Lines are extended using extend command wherever necessary.
- Donut option is used to represent the c/s of reinforcements.
- Offset command is used to get lines at regular distance.
- Hatching is done using hatch command.
- Dimensions are provided and text command is also used for labeling the drawing.

Draw the following views to a suitable scale

Plan & Cross section of circular water tank showing reinforcement details

Result: The required reinforcement detailing of circular water tank using Auto CAD software
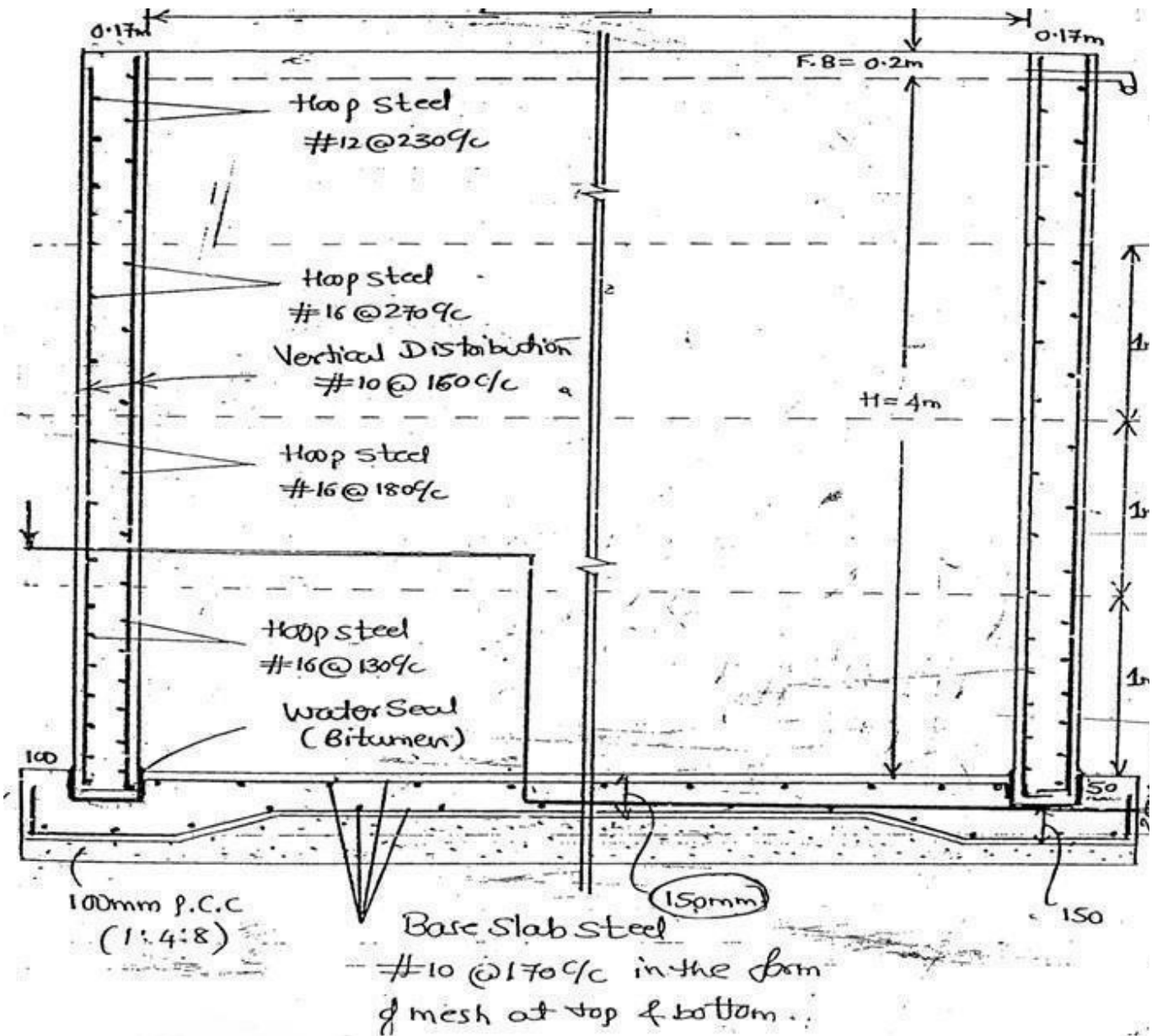
Fig.13. Cross section of Circular water tank
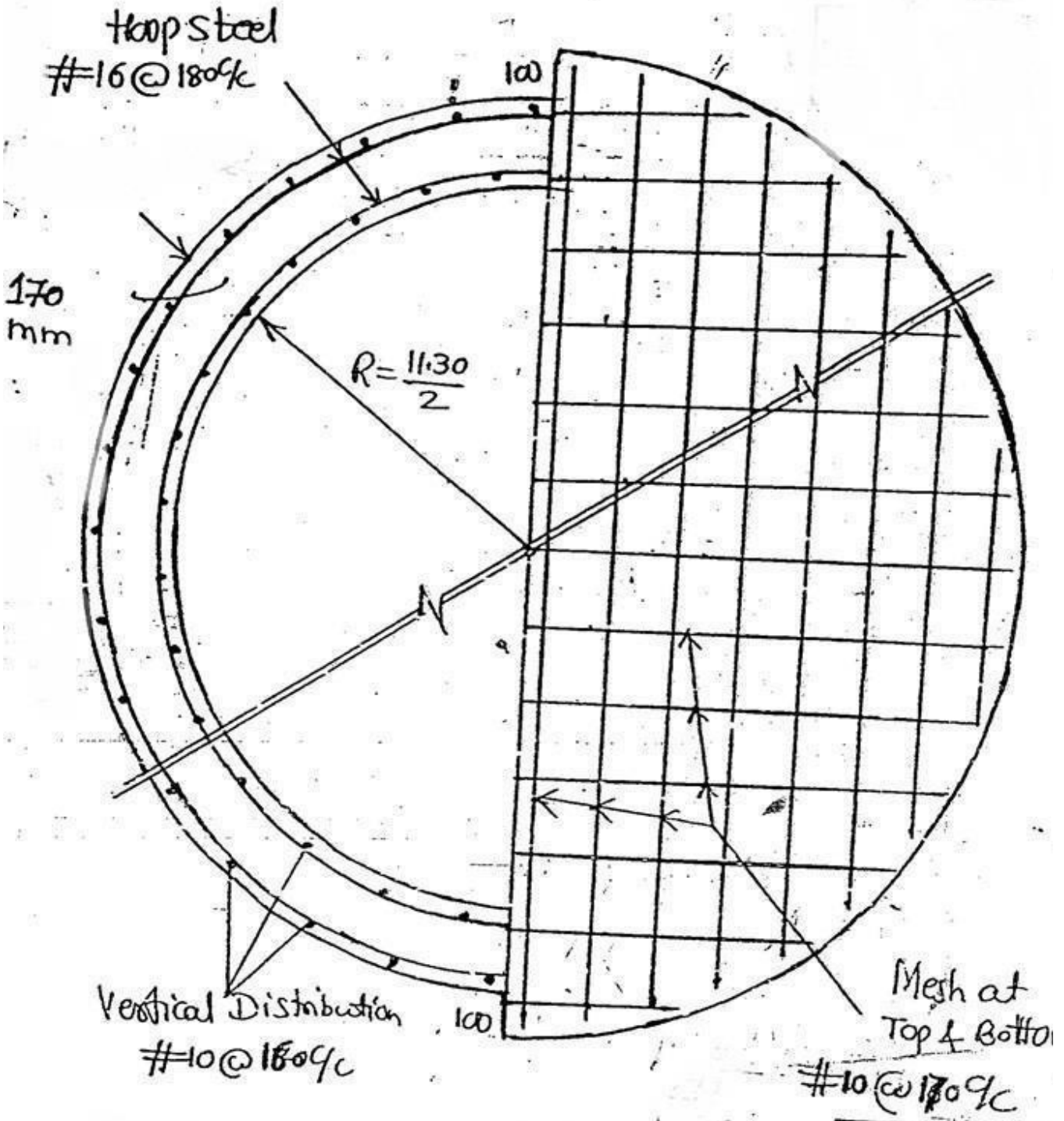
Fig.14. half plan @ through wall and half plan @ bottom of circular water tank

(a) Tank Resting on the Ground

(b) Underground Tank

(c) Elevated Water Tank

Types of Water Tanks
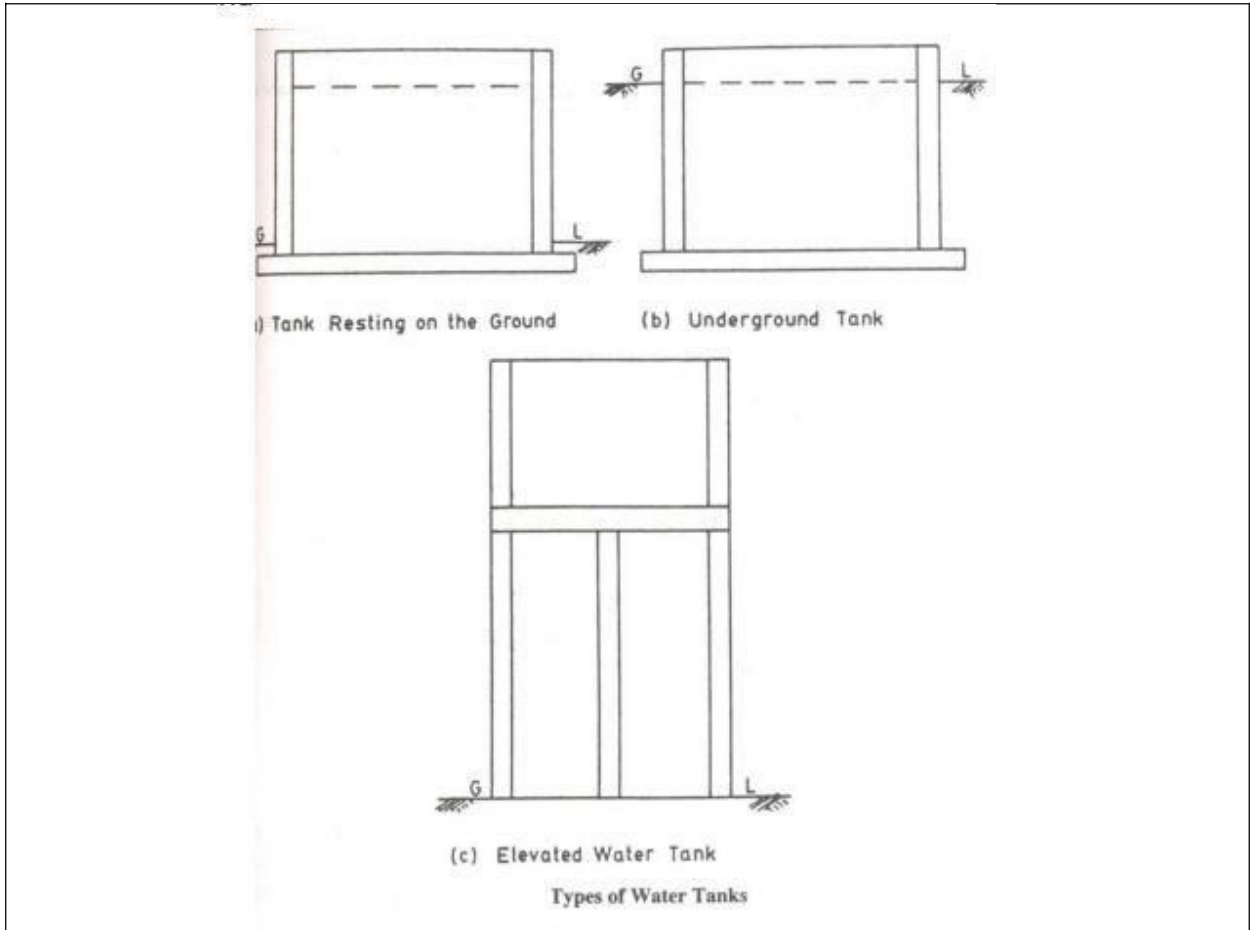
Fig.15. rectangular water tank

EXPT No: 11   **DATE:**

RECTANGULAR WATER TANK

Aim: To draw the reinforcement detailing of rectangular water tank using Auto CAD software for given data.

Problem

The following are the particulars a of rectangular water tank

Capacity of tank	– 50,000 liters-(m^3)
Size of tank	– 6 m x 4m

Depth of tank	– 3 m	Thickness of wall	– 0.22 m
Freeboard	– 0.2 m	Thickness of base slab	- 0.15 m

Total height of tank - 3.2 m

Hoop steel   - provide 12 ɸ mm @ 190 mm c/c (increase 190 mm spacing

@ every 1mheight) Vertical Distribution bars -16 ɸ mm @ 130 mm c/c

Base slab reinforcement in the form of mesh - 10 ɸ mm @ 170 mm c/c @ top and bottom

Procedure:

- The limits are set before starting the drawing. The lower left corner is set as default (0.0000, 0.0000). The upper right corner is changed as per our requirements.
- By using units command, we set the types as decimal, precision as 0.0000 and units to scale as millimeters.
- Ortho is switched off as the drawing requires use of inclined line also along with horizontal and vertical lines.
- By using the line command, the outline of the required drawing is drawn.
- By using the trim command, the extra lines are trimmed.
- Lines are extended using extend command wherever necessary.
- Donut option is used to represent the c/s of reinforcements.
- Offset command is used to get lines at regular distance.
- Hatching is done using hatch command.
- Dimensions are provided and text command is also used for labeling the drawing.

Draw the following views to a suitable scale

Cross section and longitudinal section of rectangular water tank showing reinforcement details

Result: The required reinforcement detailing of rectangular water tank using Auto CAD software
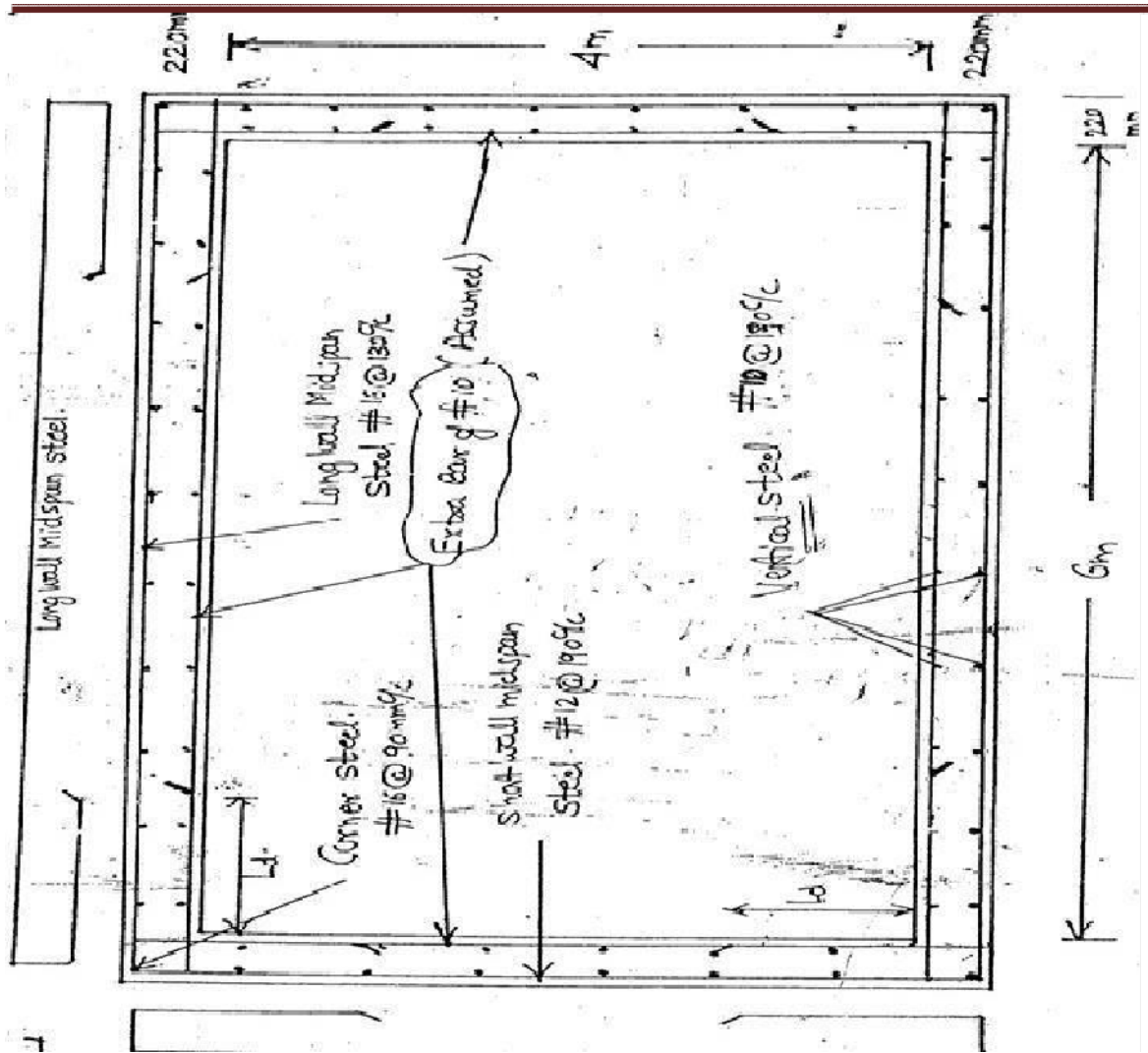
Fig.15. sectional plan of rectangular water tank

C/s Through Long Wall

0.2m F.B.

Alternate
cantilever steel
#12 @ (2×190)%c

#16 @ 130%c Long wall steel.

H=3m

Bottom 1m ht.
cantilever steel.
#12 @ 190%c

Haunch 150×150
with #8

Base Slab steel
#10 @ 170%c at top and
Bottom in the form of mesh.
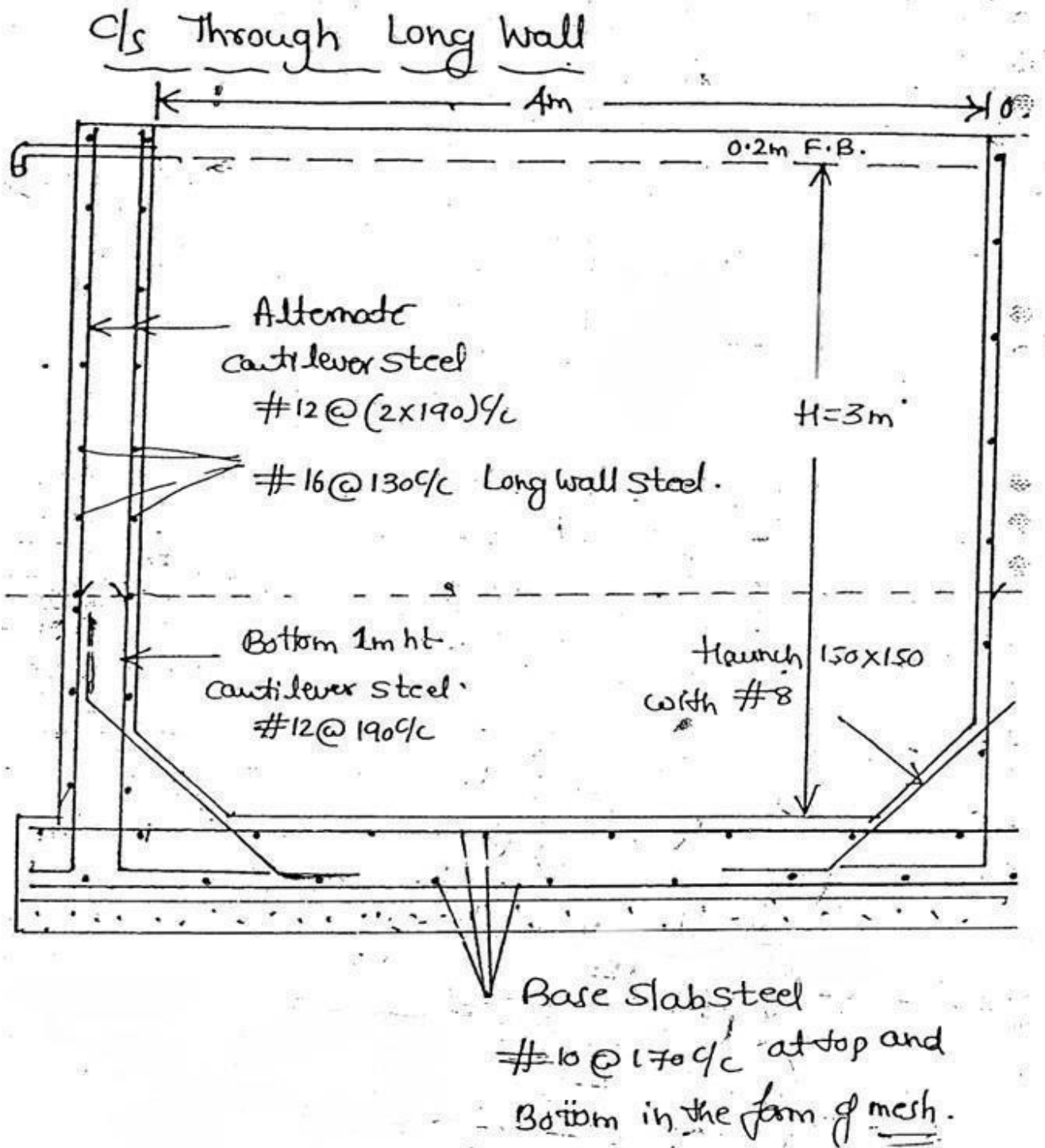
Fig.16. Cross section of rectangular water tank

Connections – Beam to Beam by bolted

All dimensions in mm

EXPT No: 12   **DATE:**

CONNECTIONS – BEAM TO BEAM BY BOLTED

Aim: To draw the connections of beam to beam by bolted, using Auto CAD software for given data.

Problem

       The following are the particulars of a beam to beam connection by bolted

       Two secondary beams ISLB 450@ 65.3 Kg/m each are to be connected to the web of the web of main beam ISLB 600 @ 99.5 Kg/m. Angles used for the connections are two nos of ISA 100X100X8 mm, 6 bolts of 20 mm dia are used to connected angle to the web of ISLB 450. 10 bolts of 20 mm dia are used to connect the angle and web of ISLB 600. Top flanges of the beams are at the same level.

Procedure:

- The limits are set before starting the drawing. The lower left corner is set as default (0.0000, 0.0000). The upper right corner is changed as per our requirements.
- By using units command, we set the types as decimal, precision as 0.0000 and units to scale as millimeters.
- Ortho is switched off as the drawing requires use of inclined line also along with horizontal and vertical lines.
- By using the line command, the outline of the required drawing is drawn.
- By using the trim command, the extra lines are trimmed.
- Lines are extended using extend command wherever necessary.
- Offset command is used to get lines at regular distance.
- Hatching is done using hatch command.
- Dimensions are provided and text command is also used for labeling the drawing.

Draw the following views to a suitable scale

       Elevation of beam to beam connections, section 1-1, section 2-2

       Result: The required drawing of beam to beam connections by bolted using Auto CAD software

Connections – beam to beam by welded

All dimensions are in mm

EXPT No: 13   **DATE:**

CONNECTIONS – BEAM TO BEAM BY WELDED

Aim: To draw the connections of beam to beam by welded, using Auto CAD software for given data.

Problem

The following are the particulars of a beam to beam connection by welded

Two secondary beams ISLB 450@ 65.3 Kg/m each are to be connected to the web of the web of main beam ISLB 600 @ 99.5 Kg/m by using double Angle welded farmed connections with the top flanges of the beam at the same level, 2 nos of cleat angle ISA 100X100X8 mm of length 200 mm each are used for the connections with 6 mm fillet weld.
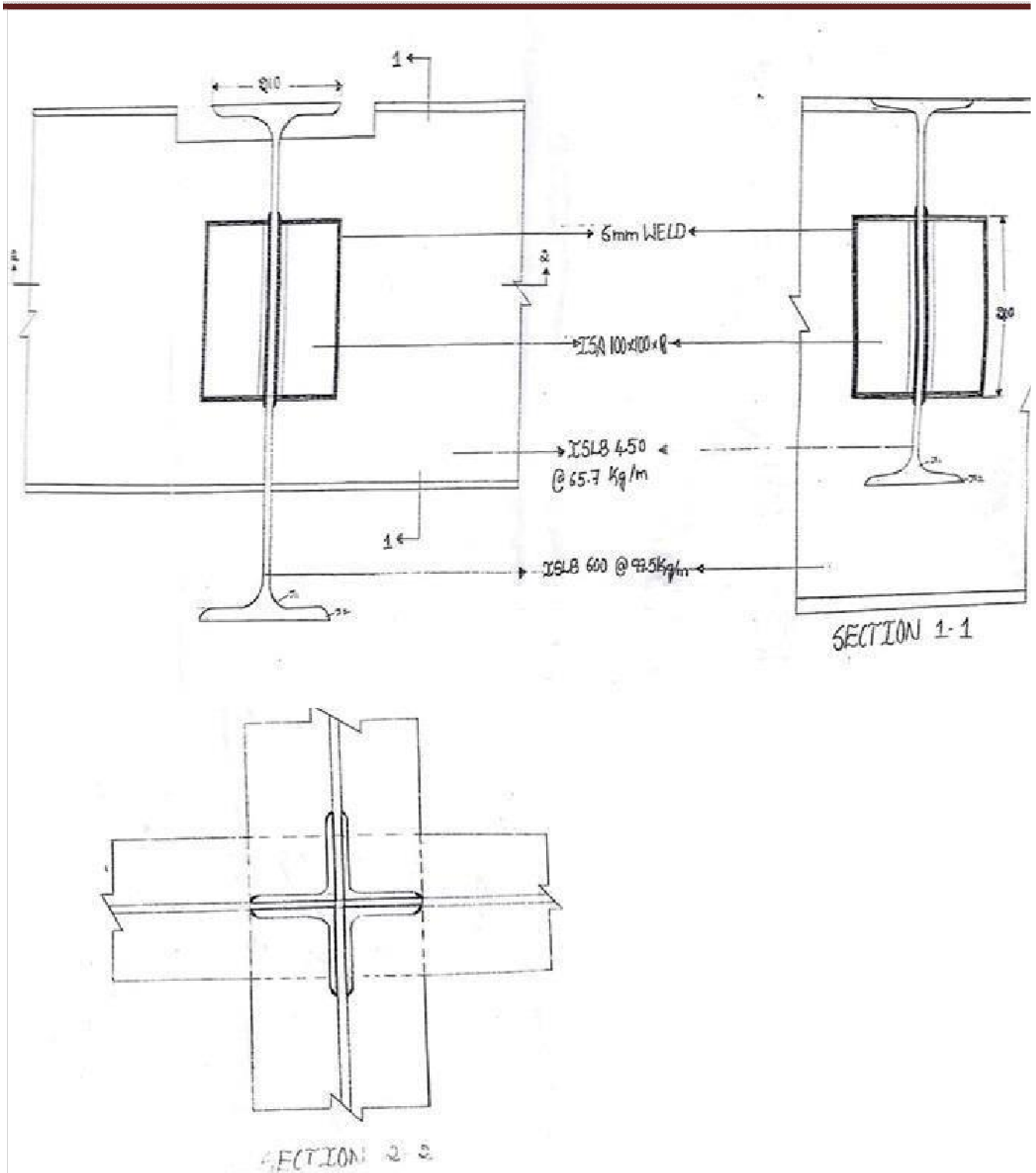
Procedure:

- The limits are set before starting the drawing. The lower left corner is set as default (0.0000, 0.0000). The upper right corner is changed as per our requirements.
- By using units command, we set the types as decimal, precision as 0.0000 and units to scale as millimeters.
- Ortho is switched off as the drawing requires use of inclined line also along with horizontal and vertical lines.
- By using the line command, the outline of the required drawing is drawn.
- By using the trim command, the extra lines are trimmed.
- Lines are extended using extend command wherever necessary.
- Offset command is used to get lines at regular distance.
- Hatching is done using hatch command.
- Dimensions are provided and text command is also used for labeling the drawing.

Draw the following views to a suitable scale

Elevation of beam to beam connections, section 1-1, section 2-2

Result: The required drawing of beam to beam connections by welded using Auto CAD software

Connections – column to Beam by bolted

ISA 90×90×8

Beam
ISMB 400 @61.6kg/m

ISHB 400 @ 77.4 kg/m
Column

SECTION 1-1

2ISA 90X90X2

SECTION 2-2

All dimensions are in mm

EXPT No: 14   **DATE:**

CONNECTIONS – COLUMN TO BEAM BY BOLTED

Aim: To draw the connections of column to beam by bolted, using Auto CAD software for given data.

Problem

The following are the particulars of a beam to beam connection by bolted
A beam of ISMB 400 @ 61.6 kg/m is connected to the flange of stanchion (column) ISHB 400 at 77.4 kg/m by a framed connections using 2 ISA 90X90X8 mm angles. 5 bolts of 20 mm dia are used to connect the angles and web of ISMB 400 @ 61.6 kg/m, 12 bolts of 20 mm dia are used to connect the angle and column ISHB 400 @77.4 kg/m.
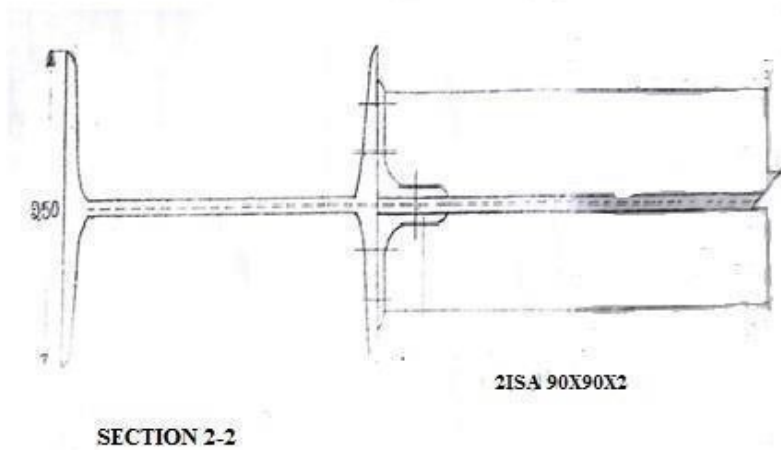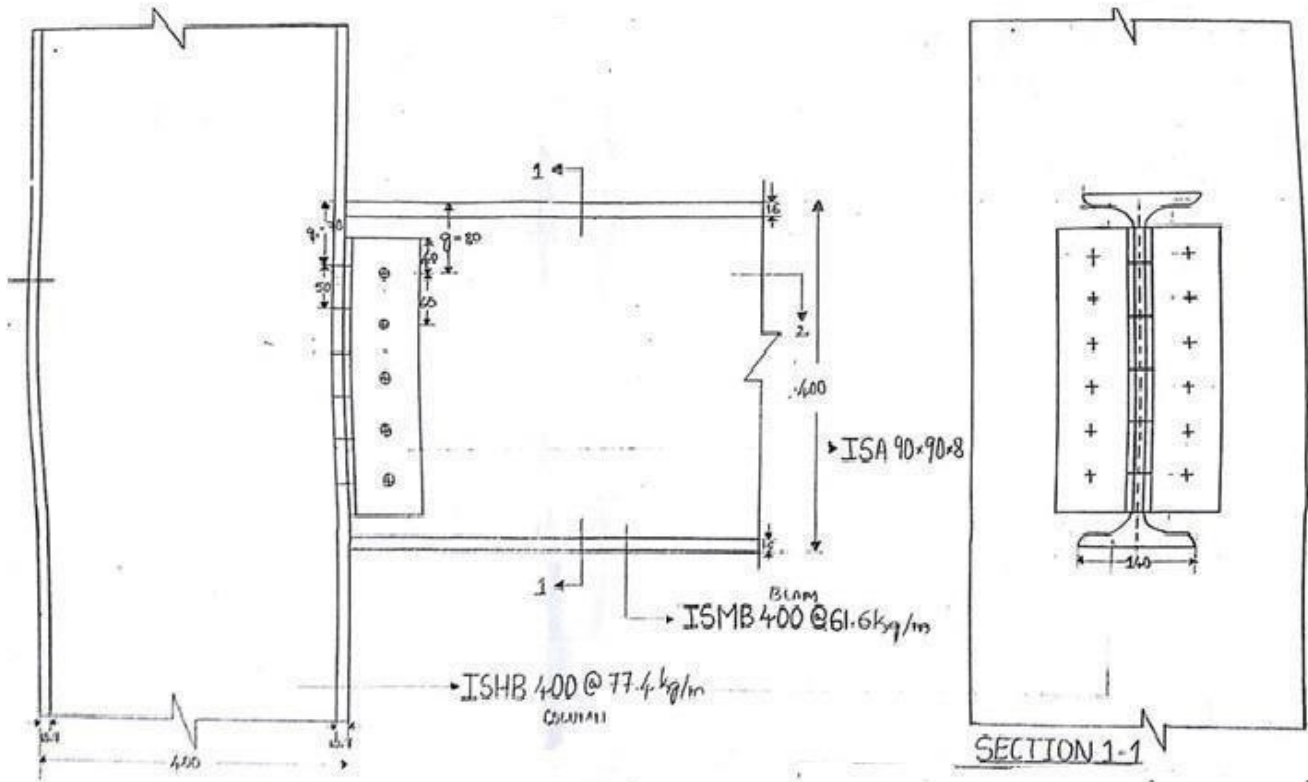
Procedure:

- The limits are set before starting the drawing. The lower left corner is set as default (0.0000, 0.0000). The upper right corner is changed as per our requirements.
- By using units command, we set the types as decimal, precision as 0.0000 and units to scale as millimeters.
- Ortho is switched off as the drawing requires use of inclined line also along with horizontal and vertical lines.
- By using the line command, the outline of the required drawing is drawn.
- By using the trim command, the extra lines are trimmed.
- Lines are extended using extend command wherever necessary.
- Offset command is used to get lines at regular distance.
- Hatching is done using hatch command.
- Dimensions are provided and text command is also used for labeling the drawing.

Draw the following views to a suitable scale

Elevation of column to beam connections, section 1-1, section 2-2

Result: The required drawing of column to beam connections by bolted using Auto CAD software

3b(i)SIDE VIEW
(beam connected to flange of column)

3b(ii)SECTIONAL PLAN

EXPT No: 15   **DATE:**

CONNECTIONS – COLUMN TO BEAM BY WELDED

Aim: To draw the connections of column to beam by welded, using Auto CAD software for given data.

Problem

The following are the particulars of a column to beam connection by welded
A beam of ISMB 400 @ 61.6 kg/m is connected to the flange of stanchion (column) ISHB 400 at 77.4 kg/m by a framed connections using 2 ISA 90X90X8 mm each of length of weld 240 mm, provide 8 mm thick weld for connecting the web of the beam and angles all around. Provide 12 mm size of weld for connecting the flange of the column and angle and provided weld along the length of the angle
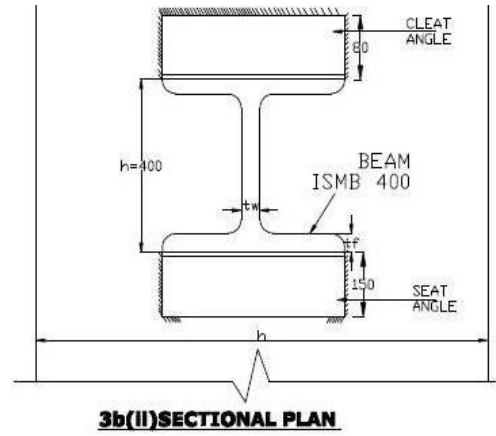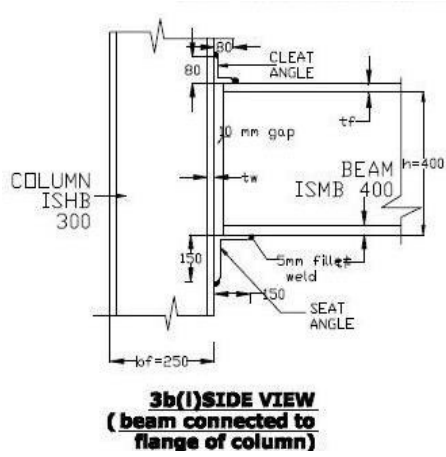
Procedure:

- The limits are set before starting the drawing. The lower left corner is set as default (0.0000, 0.0000). The upper right corner is changed as per our requirements.
- By using units command, we set the types as decimal, precision as 0.0000 and units to scale as millimeters.
- Ortho is switched off as the drawing requires use of inclined line also along with horizontal and vertical lines.
- By using the line command, the outline of the required drawing is drawn.
- By using the trim command, the extra lines are trimmed.
- Lines are extended using extend command wherever necessary.
- Offset command is used to get lines at regular distance.
- Hatching is done using hatch command.
- Dimensions are provided and text command is also used for labeling the drawing.

Draw the following views to a suitable scale

Elevation of column to beam connections, section 1-1, section 2-2

Result: The required drawing of column to beam connections by welded using Auto CAD software

Built-up Columns with lacings

FLAT
60×10MM

5MM WELD
LENGTH 60MM

TIE PLATE
350×160×8

4 ISA
100×100×12

All dimensions are in mm

EXPT No: 16   **DATE:**

BUILT-UP COLUMNS WITH LACINGS

Aim: To draw the Built-up Columns with lacings using Auto CAD software for given data.

Problem

The following are the particulars of a built up columns with lacings
A column consists of 4 ISA 100x100x12 mm angle with their backs 350 mm apart.
The lacing of column consists of 60X10 mm flat bars arranged in a single laced
system and inclined to axis of columns at angle of 50 and is connected by 5 mm size
fillet weld of 60 mm length on each side of the flat
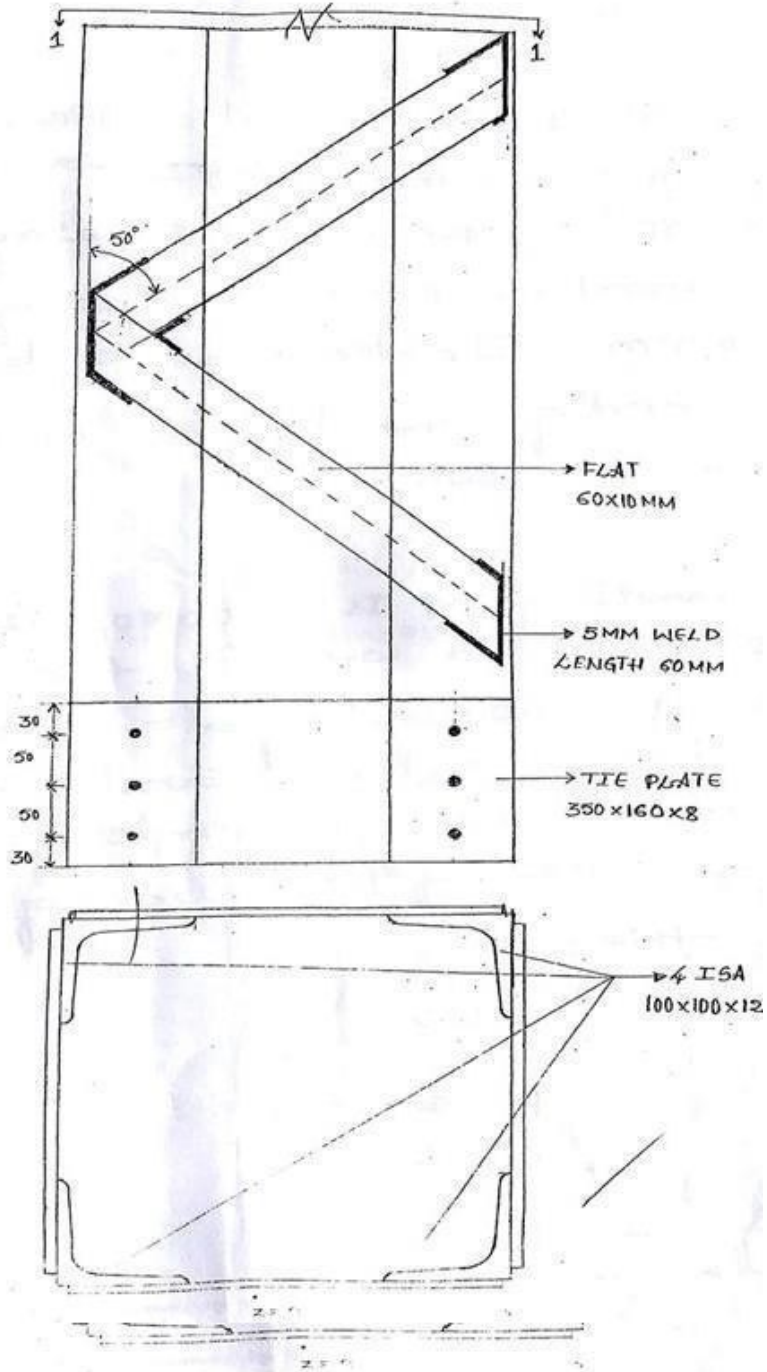

Procedure:

- The limits are set before starting the drawing. The lower left corner is set as
  default (0.0000, 0.0000). The upper right corner is changed as per our
  requirements.
- By using units command, we set the types as decimal, precision as 0.0000
  and units to scale as millimeters.
- Ortho is switched off as the drawing requires use of inclined line also along with
  horizontal and vertical lines.
- By using the line command, the outline of the required drawing is drawn.
- By using the trim command, the extra lines are trimmed.
- Lines are extended using extend command wherever necessary.
- Offset command is used to get lines at regular distance.
- Hatching is done using hatch command.
- Dimensions are provided and text command is also used for labeling the drawing.

Draw the following views to a suitable scale

Elevation of Built-up Columns with lacings, section 1-1,

Result: The required drawing of Built-up Columns with lacings using Auto CAD
software

Built-up Columns with batten

END BATTENED
(x x)

FLAT
(340 ×6)

c/c DISTANCE
BETWEEN TWO
CONSECUTIVE BATTEN
550

70

100

100

70

INTERMEDIATE BATTENE

(x x)

340

BATTENED WITH
FLAT (340×6 mm)

JISMB 300 @ 44.2 kg/m.

250

c/c SPACING OF
I - SECTION

All dimensions are in mm

EXPT No: 17   **DATE:**

BUILT-UP COLUMNS WITH BATTEN

Aim: To draw the Built-up Columns with batten using Auto CAD software for given data.

Problem

The following are the particulars of a built up columns with batten
A column consists of 2 ISMB 300 @ 44.2 kg/m space at 250mm c/c is connected
with battens flat 340 x 6 mm , 12 nos of bolts 20 mm dia . the c/c distance between
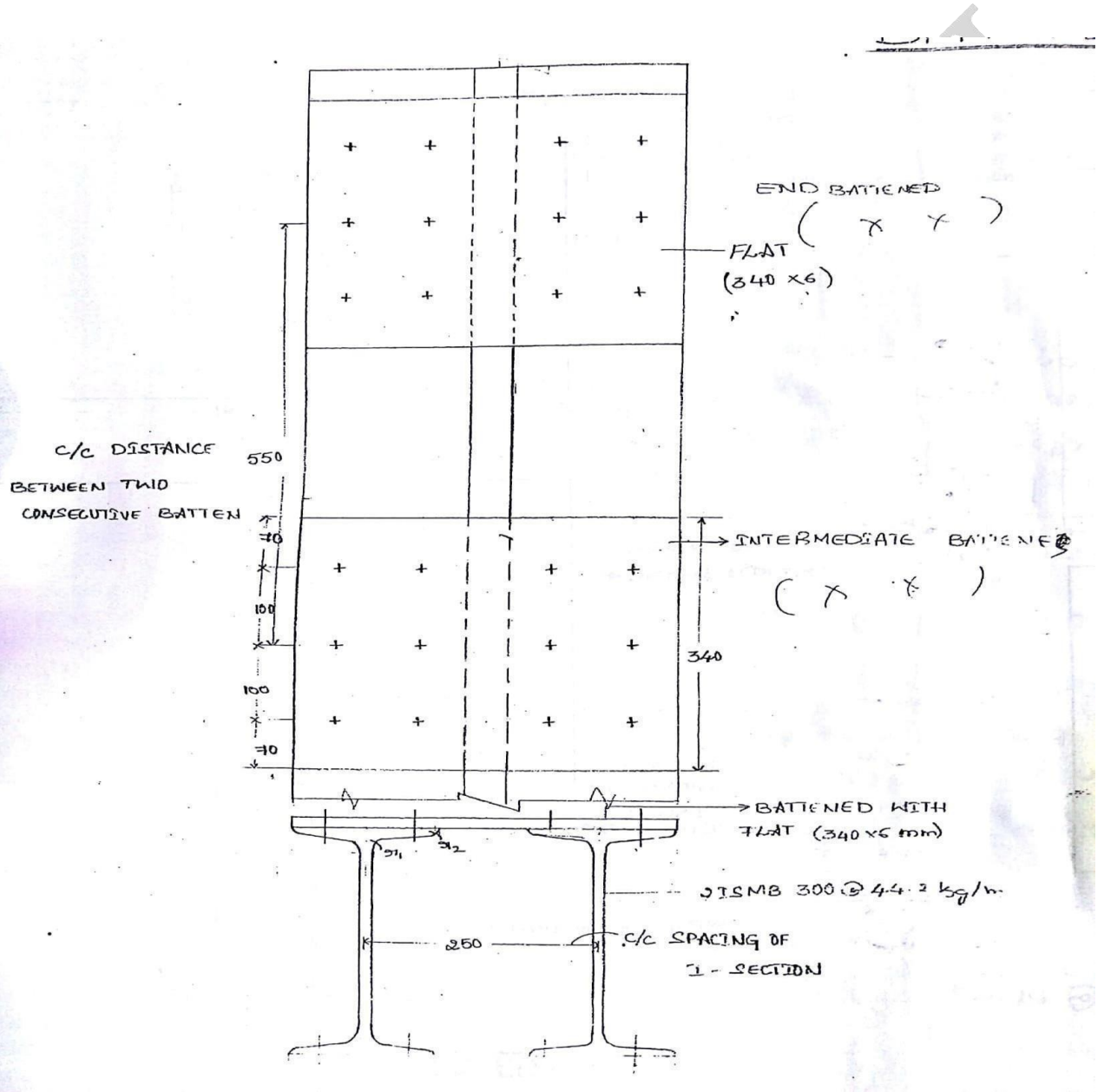two battens is 550 mm,

Procedure:

- The limits are set before starting the drawing. The lower left corner is set as default (0.0000, 0.0000). The upper right corner is changed as per our requirements.
- By using units command, we set the types as decimal, precision as 0.0000 and units to scale as millimeters.
- Ortho is switched off as the drawing requires use of inclined line also along with horizontal and vertical lines.
- By using the line command, the outline of the required drawing is drawn.
- By using the trim command, the extra lines are trimmed.
- Lines are extended using extend command wherever necessary.
- Offset command is used to get lines at regular distance.
- Hatching is done using hatch command.
- Dimensions are provided and text command is also used for labeling the drawing.

Draw the following views to a suitable scale

Elevation of Built-up Columns with batten section 1-1,

Result: The required drawing of Built-up Columns with batten using Auto CAD software

ISHB 250 @ 51 kg/m

CLEAT ANGLE 90x90x8

SLAB BASE 450x450x16

CONCRETE PEDESTAL 1500X1000X90

All dimensions are in mm

EXPT No: 18   DATE:

COLUMN SLAB BASE (BOLTED)

Aim: To draw the column slab base with bolted using Auto CAD software for given data.

Problem

The following are the particulars of a built up column
slab base with bolted Slab base for a column ISHB 250
@ 51 kg/m is detailed as given below.
Slab base 450 x 450 x 16 mm thick
Cleat angle 90 x 90 x 8 mm, connection done by nominal bolts, size of concrete
pedestal 1500 x 1000 x 900 mm of 16 mm dia anchor bolts are provided for
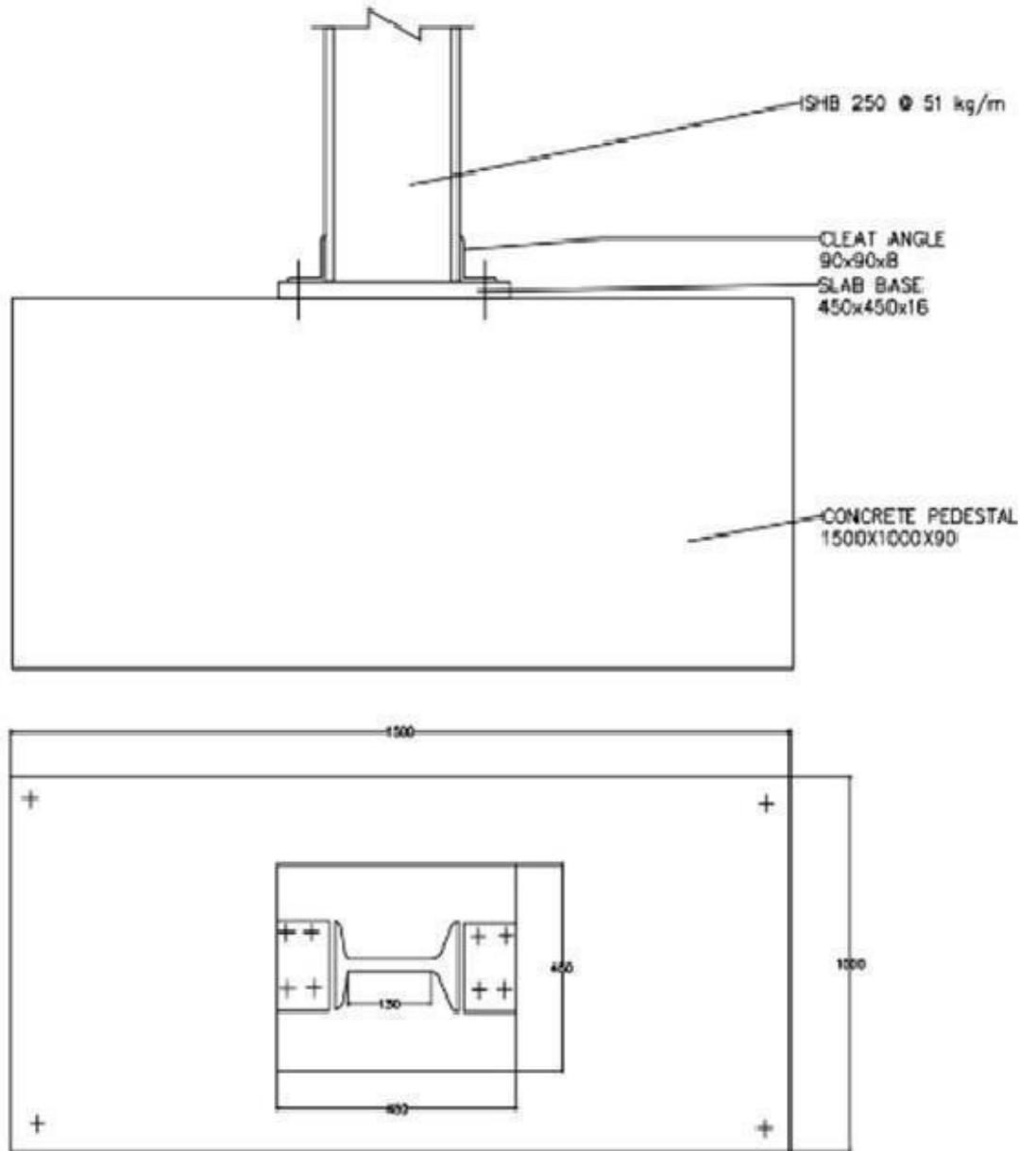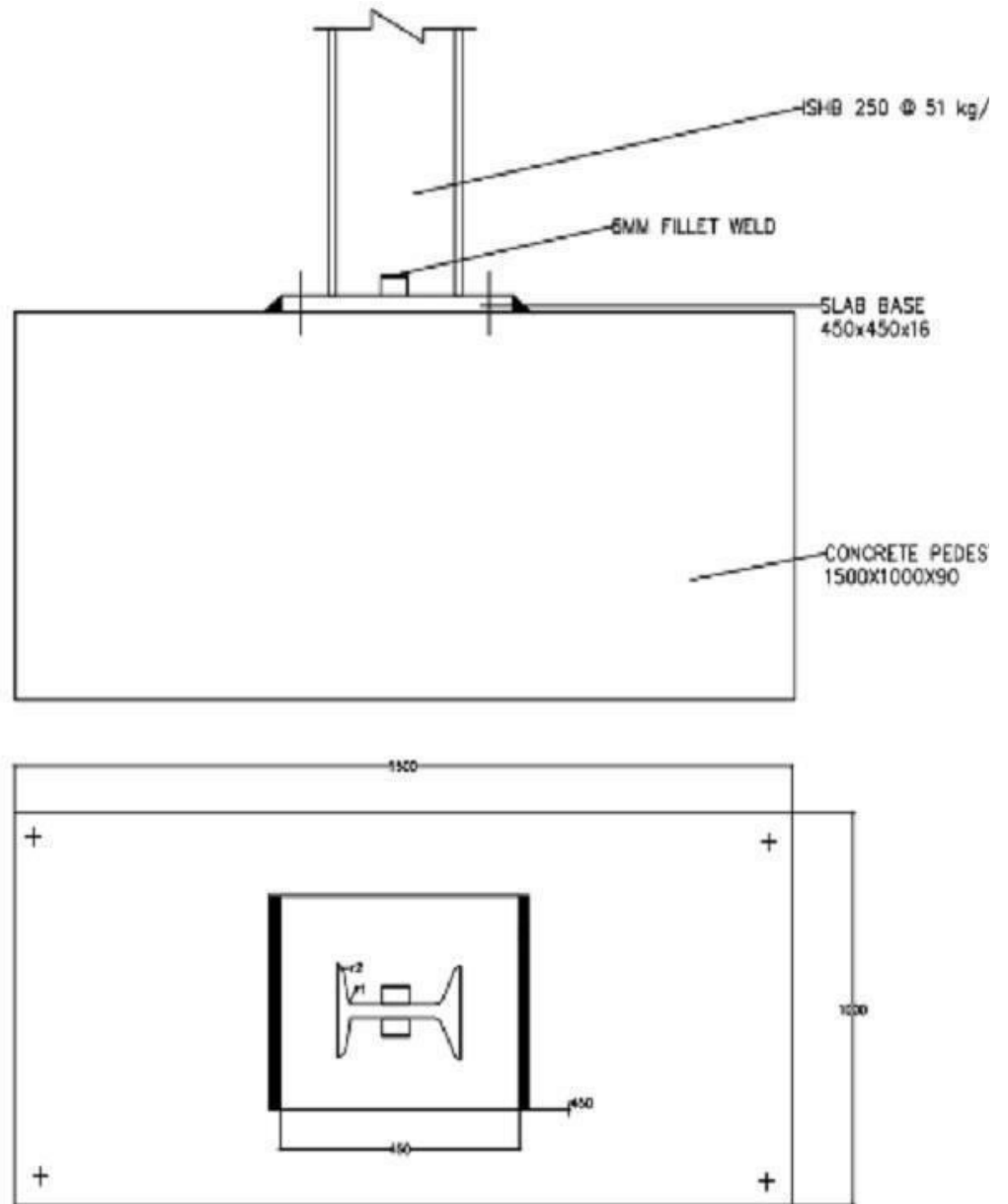connecting base plate to the concrete

Procedure:

- The limits are set before starting the drawing. The lower left corner is set as
  default (0.0000, 0.0000). The upper right corner is changed as per our
  requirements.
- By using units command, we set the types as decimal, precision as 0.0000
  and units to scale as millimeters.
- Ortho is switched off as the drawing requires use of inclined line also along with
  horizontal and vertical lines.
- By using the line command, the outline of the required drawing is drawn.
- By using the trim command, the extra lines are trimmed.
- Lines are extended using extend command wherever necessary.
- Offset command is used to get lines at regular distance.
- Hatching is done using hatch command.
- Dimensions are provided and text command is also used for labeling the drawing.

Draw the following views to a suitable scale

Elevation of column slab base with bolted, section 1-1

Result: The required drawing of column slab base with bolted using Auto CAD
software

ISHB 250 @ 51 kg/

6MM FILLET WELD

SLAB BASE
450x450x16

CONCRETE PEDES'
1500X1000X90

All dimensions are in mm

EXPT No: 19   **DATE:**

COLUMN SLAB BASE (WELDED)

Aim: To draw the column slab base with welded using Auto CAD software for given data.

Problem

The following are the particulars of a built up column
slab base with bolted Slab base for a column ISHB 250
@ 51 kg/m is detailed as given below.
Slab base 450 x 450 x 16 mm thick
Cleat angle 90 x 90 x 8 mm, connection done by fillet weld of size 6mm, size of
concrete pedestal 1500 x 1000 x 900 mm of 16 mm dia anchor bolts are provided for
connecting base plate to the concrete

Procedure:

- The limits are set before starting the drawing. The lower left corner is set as default (0.0000, 0.0000). The upper right corner is changed as per our requirements.
- By using units command, we set the types as decimal, precision as 0.0000 and units to scale as millimeters.
- Ortho is switched off as the drawing requires use of inclined line also along with horizontal and vertical lines.
- By using the line command, the outline of the required drawing is drawn.
- By using the trim command, the extra lines are trimmed.
- Lines are extended using extend command wherever necessary.
- Offset command is used to get lines at regular distance.
- Hatching is done using hatch command.
- Dimensions are provided and text command is also used for labeling the drawing.

Draw the following views to a suitable scale

Elevation of column slab base with welded, section 1-1

Result: The required drawing of column slab base with welded using Auto CAD software

COLUMN GUSSETED BASE

Elevation

Cross-section
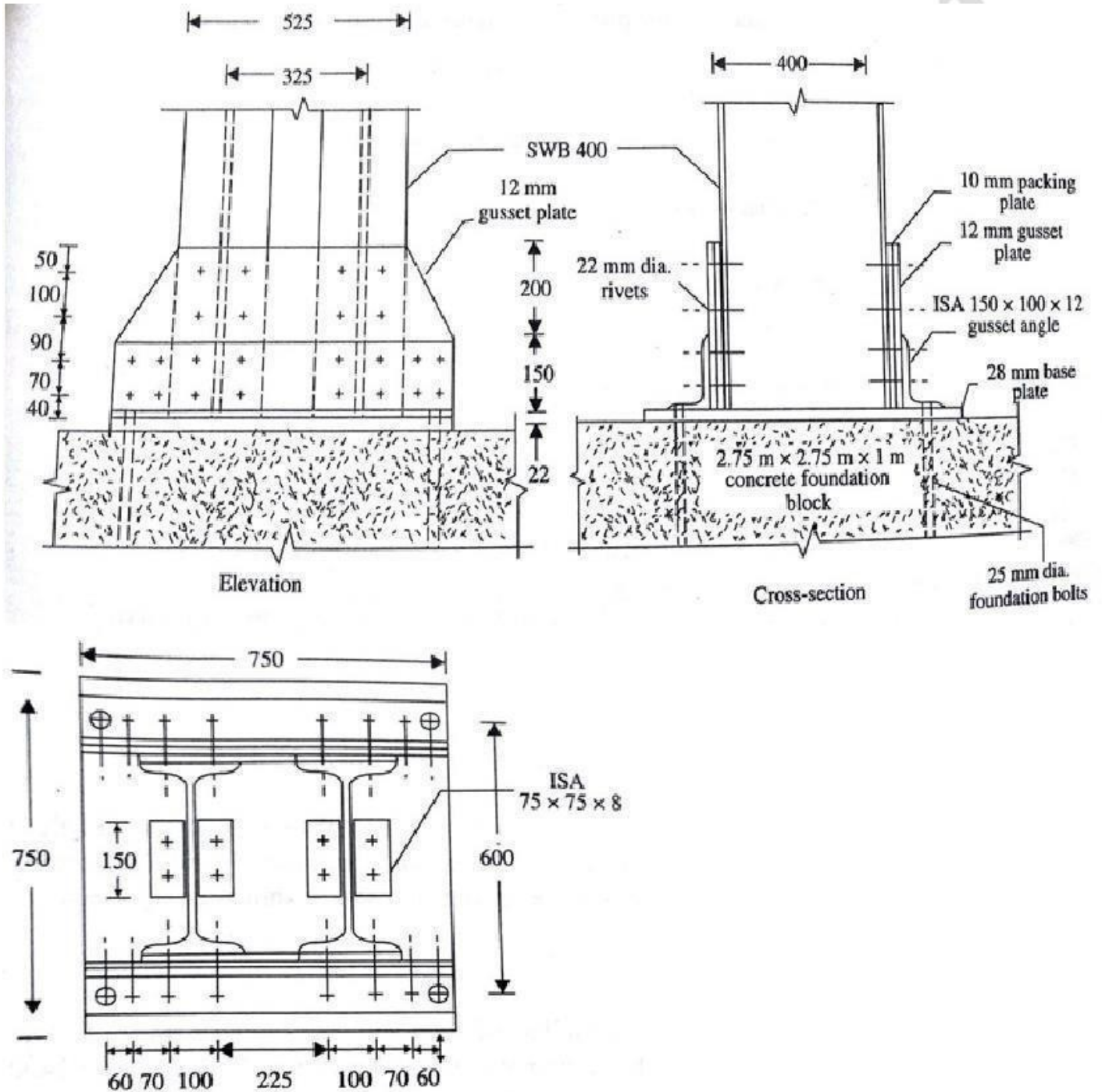
All dimensions are in mm

EXPT No: 20   **DATE:**

COLUMN GUSSETED BASE

Aim: To draw the column gusseted base with bolted using Auto CAD software for given data.

Problem

The following are the particulars of a built up column gusseted base with bolted
A gusseted base for a column sections ISHB 400 @ 82.2 kg/m with flange plate
300 x 14 mm one on each flange is to be detailed with the following details
Base plate size
750 x 750 x28
mm Gusset
plate 12 mm
Gusset angle 2 ISA 150 x 100 x 12 mm
Gusset plate and flange plate connected by 8 nos of bolts on one side in two column of size 28 mm dia

Procedure:

- The limits are set before starting the drawing. The lower left corner is set as default (0.0000, 0.0000). The upper right corner is changed as per our requirements.
- By using units command, we set the types as decimal, precision as 0.0000 and units to scale as millimeters.
- Ortho is switched off as the drawing requires use of inclined line also along with horizontal and vertical lines.
- By using the line command, the outline of the required drawing is drawn.
- By using the trim command, the extra lines are trimmed.
- Lines are extended using extend command wherever necessary.
- Offset command is used to get lines at regular distance.
- Hatching is done using hatch command.
- Dimensions are provided and text command is also used for labeling the drawing.

Draw the following views to a suitable scale

Elevation of column gusseted base with bolted, section and top view

Result: The required drawing of column gusseted base with bolting using Auto CAD software
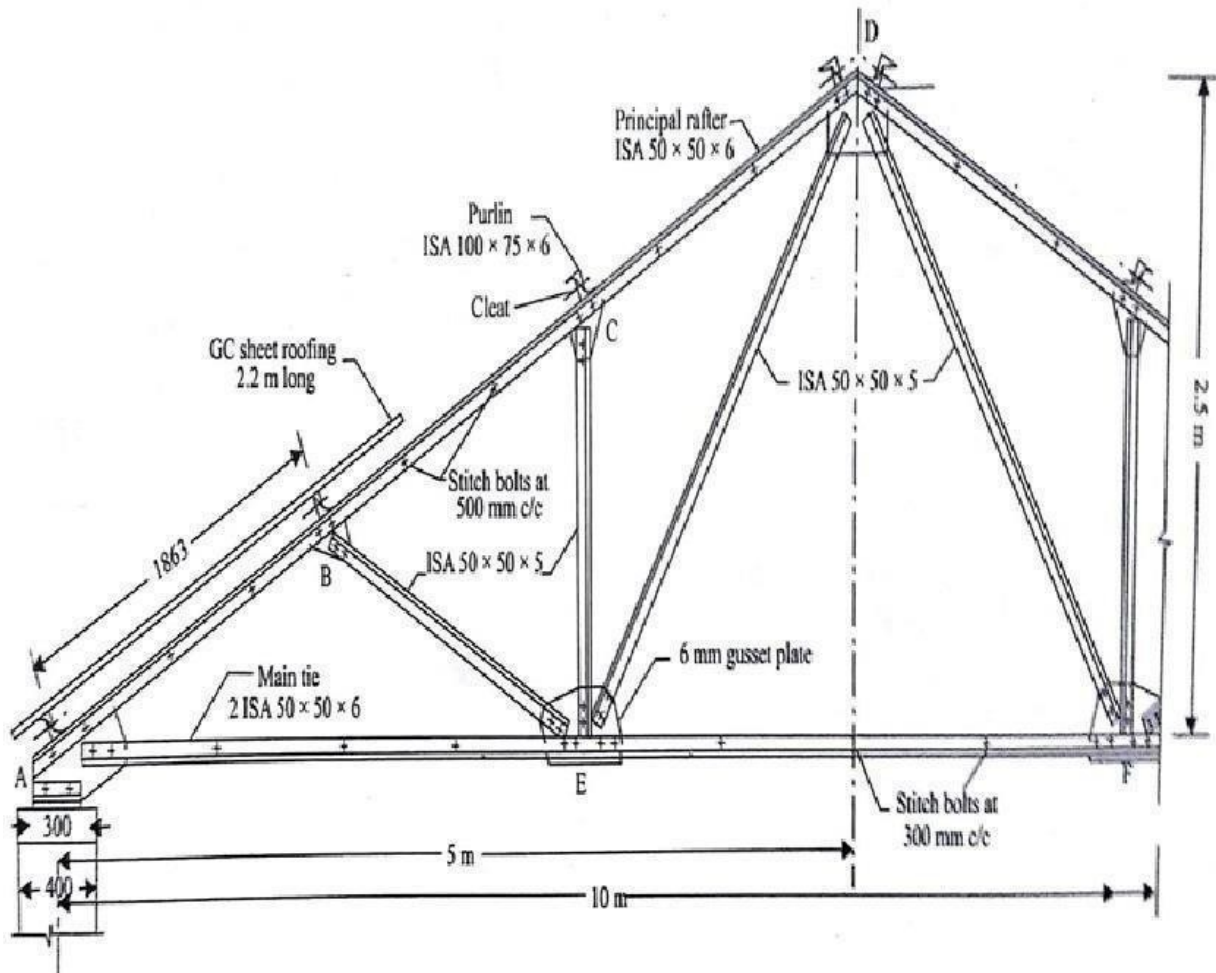
EXPT No: 21   **DATE:**

ROOF TRUSS BOLTED CONNECTION

Aim: To draw the roof truss bolted connections using Auto CAD software for given data.

Problem

> The following are the particulars of a the roof truss
> bolted connections Size of the column 400 x 400 mm
> Bearing plate of size 300 x 300 x5 mm
> Shoe angle is used to connect to top chord and the column of size 2
> ISA 50 x 50 x 6 mm 06 mm thick Gusseted plate is used to connect
> the members
> Top chord 2 ISA 50 x 50 x 6 mm is provide @ angle of 30°
> over the shoe angle Bottom chord 2 ISA 50 x 50x 6 mm
> Strut 2 ISA 50 x 50 x 5 mm @ angle 60° over the bottom chord to
> connect the top chord Purlins are used to connect the sheet of size
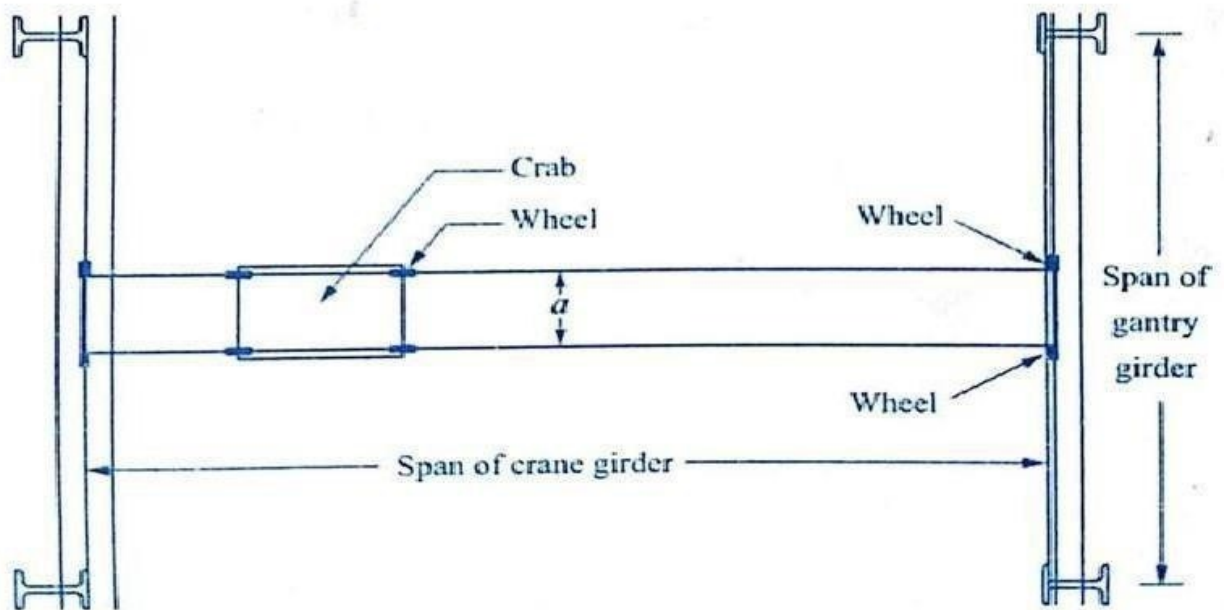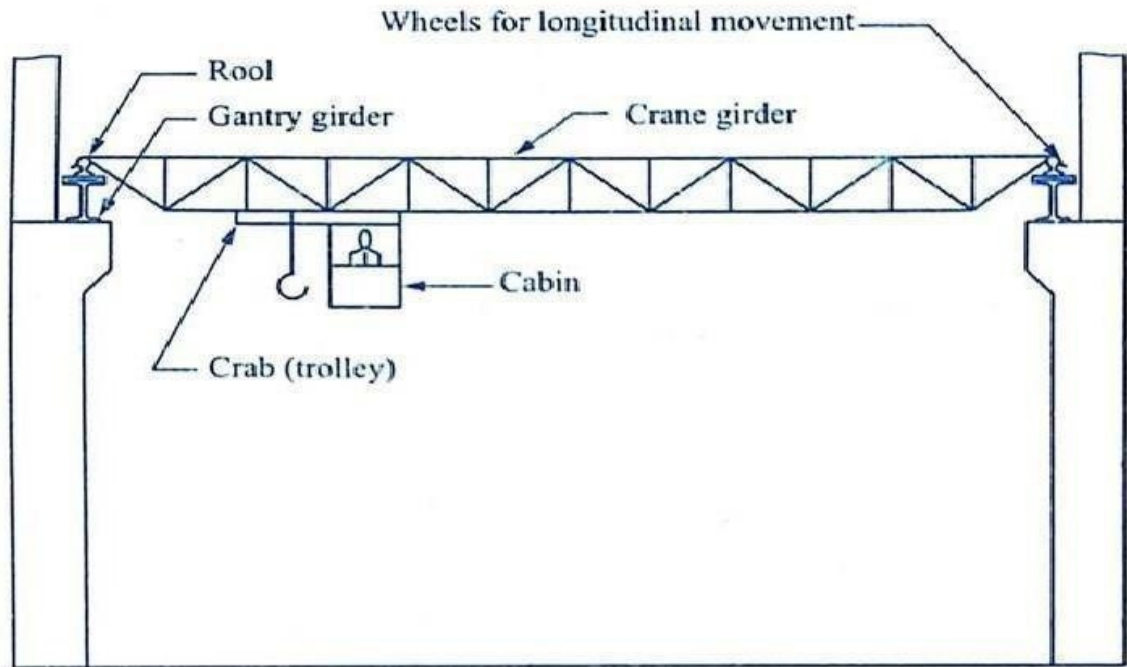> ISA 100 x 75 x 6 mm with cleat angles

Procedure:

- The limits are set before starting the drawing. The lower left corner is set as default (0.0000, 0.0000). The upper right corner is changed as per our requirements.
- By using units command, we set the types as decimal, precision as 0.0000 and units to scale as millimeters.
- Ortho is switched off as the drawing requires use of inclined line also along with horizontal and vertical lines.
- By using the line command, the outline of the required drawing is drawn.
- By using the trim command, the extra lines are trimmed.
- Lines are extended using extend command wherever necessary.
- Offset command is used to get lines at regular distance.
- Hatching is done using hatch command.
- Dimensions are provided and text command is also used for labeling the drawing.

Draw the following views to a suitable scale

> Elevation the roof truss with bolted, section and top view

Result: The required drawing of the roof truss with bolting using Auto CAD software

EXPT No: 22   **DATE:**

GANTRY GIRDER

Aim: To draw the Gantry Girder with bolted connections using Auto CAD software for given data.

Problem

The following are the particulars
of a the gantry girder Distance
between the centers of gantry rails
15 m Span of gantry girder 7.50 m
Distance between the centers of crane wheel 3.5 m
Gantry girder details ISWB 600 (1.23 kn/m) with a channel ISMC 300

Procedure:

- The limits are set before starting the drawing. The lower left corner is set as default (0.0000, 0.0000). The upper right corner is changed as per our requirements.
- By using units command, we set the types as decimal, precision as 0.0000 and units to scale as millimeters.
- Ortho is switched off as the drawing requires use of inclined line also along with horizontal and vertical lines.
- By using the line command, the outline of the required drawing is drawn.
- By using the trim command, the extra lines are trimmed.
- Lines are extended using extend command wherever necessary.
- Offset command is used to get lines at regular distance.
- Hatching is done using hatch command.
- Dimensions are provided and text command is also used for labeling the drawing.

Draw the following views to a suitable scale

Elevation the Gantry Girder with bolted and top view (Plan)

Result: The required drawing of the Gantry Girder with bolting using Auto CAD software

Viva questions

1. Define RCC

2. Define characteristic strength (f_{ck}) of concrete

3. Define integrated structure

4. Name the types of steel and their relevant IS standards to be used as reinforcement in concrete.

5. State four objectives of the design of reinforced concrete structure.

6. What are the two methods of design of reinforced concrete structural elements?

7. How to estimate the design loads in (i) limit state method, and (ii) working stress method?

8. Define characteristic load.

9. What are the main (i) loads, (ii) forces and (iii) effects to be considered while designing the structures?

10. explain the situations when doubly reinforced beams are designed

11. name three cases other than doubly reinforced beams where compression reinforcement is provided

12. state the assumptions of analysis and design of doubly reinforced beams,

13. What is lever arm

14. Define limit state method

15. Define partial safety factors

16. Define singly reinforced beam

17. Define doubly reinforced beam

18. Define balanced section

19. Define under reinforced beam

20. Define over reinforced beam

21. Define short term deflection

22. Define long term deflection

23. Define moment

24. Name the different types of the beam

25. Define neutral axis

26. State the maximum spacing of stirrups in beams

27. Explain the steps involved in the design of beam

28. Explain the steps involved in the design of slabs.

29. state the names of different types of slabs used in construction

30. define one way slab

31. define two way slab

32. State the minimum amounts of reinforcing bars to be provided in slabs

33. State span to depth ratios of one-way slabs for different support conditions to be considered for the control of deflection.

34. State the maximum diameter of a bar to be used in slabs.

35. State the maximum spacing between the bars.

36. Name the two types of two-way slabs.

37. Explain the importance of the bond and why is it essential to provide between steel and concrete in beams?

38. Define staircase

39. Name the different types of stairs

40. Explain the steps involved in the design of staircase

41. What is the function of shear keys in the design of retaining walls

42. Define retaining wall

43. Explain the functions of retaining walls

44. Name the different types of retaining walls

45. Name the earth pressure acting on the retaining walls

46. Define active earth pressure

47. Define passive earth pressure

48. Explain the principle of the design of retaining walls