COURSE HANDOUT
ENGINEERING DRAWING
(EDRG 101 & EDRG 102)

Prepared by:
Suman Aryal
Shanti Prajapati
Pratisthit Lal Shrestha
Department of Mechanical Engineering

Shyam Sundar Khadka
Department of Civil & Geomatics Engineering

Department of Mechanical Engineering
Department of Civil & Geomatics Engineering
School of Engineering
Kathmandu University
Dhulikhel, Kavre

ENGINEERING DRAWING (EDRG 101 & 102)
COURSE SYLLABUS

Lecture Duration: 1 hour
Practical Duration: 3 hours

EDRG 101

Weeks	Hand Drawing	CAD
1	Lettering & Free hand drawing	
2	Dimensioning & Scaling	
3	Engineering Curves (Ellipse, Parabola)	
4		Introduction, Drawing Setup, Formatting
5	**First Internal**	
6	Engineering Curves (Hyperbola, Cycloid, Spiral)	
7		Basic Commands, Draw toolbar
8	Projection (Point, Line, Surface)	
9		Advanced Command, Object & Modify toolbar
10	Projection (Solid)	
11		Dimensioning
12		Engineering Curves (HD sheet no 3 /4)
13	Surface Development	
14		Projection & Surface Development
15	**Second Internal**	

EDRG 102

Weeks	Hand Drawing	CAD
1	Orthographic Projection I	
2	Orthographic Projection II	
3		Review of previous semester + Orthographic Projection
4	Orthographic Projection III (Sectioning)	
5		Orthographic Projection
6	**First Internal**	
7	Isometric Drawing I	
8	Isometric Drawing II	
9		Isometric Projection
10	Nuts and Bolts	
11		Isometric Projection
12	Rivet and Riveted Joints	
13		Mechanical Engg / Civil Engg Drawings
14		Mechanical Engg / Civil Engg Drawings
15	**Second Internal**	

Note:
Internal Marks: 80

- Drawing Sheets (12 sheets): 60 (Hand Drawing, CAD)
- Internal Assessments (2): 20 (Hand Drawing, CAD)

Final Marks: 20

EDRG 101

Week	Topic	Course Outline	Class hours	Remarks
1	**Introduction to Engineering Drawing and Lettering**	Introduction to Engineering Drawing and Instruments Used in Engineering Drawing: E.g. - Drafter, types of Pencil, set squares and etc.	1	**Lecture**
		Layout of Drawing Sheets, Types of Lines, Lettering and its types.		
		Layout and lettering Practice.		
	Exercise : 1		3	**Practice**
	Write freehand single stroke Vertical-capital and small letters (From A-H) of type A of height 14mm.			
	Write the following in inclined vertical capital letters of type B of height 10mm.**ENGINEERING DRAWING**			
2	**Dimensioning and Scaling**	Dimensioning: Unit of Dimensions, System of Dimensioning	1	**Lecture**
		Engineering Scale: Representative Factor,		
		Construction and Types of Scales:Plain Scales, Diagonal Scales, Vernier Scales, Comparative Scales, Scale of Chords		
	Exercise : 2		3	**Practice**
	1	Construct a plain scale to read centimeter and decimeter and long enough to measure 6 decimeter. Use RF=1/4. show on it a distance of 4.7 meter.		
	2	A distance of 30cm measured on a map amounts to 450meter. Draw a diagonal scale showing divisions of 50cm capable of measuring 300 meter. Mark on it 255.5 meter and 177.5 meter.		
	3	Construct a Vernier scale of RF=1:20 to read meter, tenth of a meter and centimeter with the aid of the scale, draw a line of length 2.18m.		
	4	A car is running at a constant speed of 80km/hr. construct a plain scale long enough to read upto 65km. choose a suitable RF which limits the length of scale between 17cm-19cm. Also show on the scale the time taken to covera distance of 60km.		
3	**Geometrical construction**	To divide the lines into any number of equal parts.	1	**Lecture**
		To divide a given angle into even number of divisions.		
		To draw an arc tangential to a line and passing through a point.		
		Construction of regular polygons.		
	Conic Sections : Ellipse and Parabola	**Conic Section**: Definition and Terminology, Applications, Construction of Conic Sections. **Ellipse**: Finding out foci when Major and Minor axis are given, Different methods of construction, Drawing Tangents to Ellipse at a point *on* the ellipse or from a point *outside* the ellipse. **Parabola:** To find the axis, focus and directrix of a Parabola, Drawing Tangents to the Parabola either at a point *on* the Parabola or from a point *outside* the Parabola when: the focus and directrix are given the focus and directrix are not given		
	Exercise : 3		3	**Practice**
	1	Construct the following polygons, a. Regular pentagon of 40mm side inscribing in a circle. **b.** Regular hexagon of 30mm side.		
	2	Trace the different conic sections when the distance of the locus from the directrix is 30mm and eccentricity is equal to, i) 7/9 ii) 1 and iii) 9/7. Name the curves.		

	3	A line AB represents the major axis of an ellipse and measures 120mm. A point P is at a distance of 90mm from A and 50mm from B. Draw the elliptical curve passing through the points P, A and B. Find the eccentricity of the curve. Draw tangent to the ellipse at any point *on* the curve.			
	4	A particle moves such that the sum of its distance from the two fixed points A and B, 90mm apart remains constant. When P is at equal distance from A and B, its distance from each one of them is 75mm. draw the path traced out by the particle P. Also draw tangent to the curve from any point *outside* the curve.			
	5	The distance of the focus from the directrix is 60mm. trace the path of the point, which moves such that its distance from the focus is equal to its distance from the directrix.			
	6	A toy rocket thrown up in the air reaches a maximum height of 45meter and travels a horizontal distance of 75 meter. Trace the path of the rocket. Choose appropriate scale.			
4	**Introduction to CAD**		Auto CAD Software for the Engineering Graphics and its application	**1**	**Lecture**
			Description of the Drawing screen and setting up Drawing		
			Getting Started with CAD and initial setup commands		
	Exercise : 4				
	1	Introduction to latest version of CAD software in lab.		**3**	**Practice**
	2	Introduction of basic commands like LINE, ERASE, SCALE, CIRCLE and their usage			
	3	Drawing different figure using above mentioned commands(Figures are in Annex)			
5	**First Internal**				
6	**Engineering Curves (Hyperbola, Involute, Spiral, cycloid)** **Definition, Terminology and Applications of Trochoid, Epitroichoid and Helix**		**Hyperbola :** Drawing Tangents to the Hyperbola either at a point *on* the Hyperbola or from the point *outside* the Hyperbola, Construction of Rectangular Hyperbola. **Involute**: Definition and construction of involutes of Circle, triangle, polygon **Spiral**: Definition and construction, draw tangent and normal at any point on the spiral **Cycloid**: Definition and construction, draw tangent and normal at any point on the cycloid	**1**	**Lecture**
	Exercise : 5				
	1	The vertex of a hyperbola is 65mm from its focus. Draw the two parts of the hyperbola if eccentricity is 2.5.		3	**Practice**
	2	The asymptotes of a hyperbola are inclined at 70^0 to each other. A point P on the curve is at a distance of 25mm and 15mm from the two asymptotes. Draw two parts of the hyperbola passing through the point P			
	3	Draw the locus of the end point of a cable unwinding itself from a drum of 80mm diameter such that the unwound cable is always taut.			
	4	Draw the Archimedean spiral for one and half convolution. The spiral starts from the pole and the greatest radius is 75mm. draw the tangent to the curve at a point 25mm from the pole.			
	5	A circle of 50mm diameter rolls on a straight line without slipping. Trace the locus of a point on the circumference if the circle rolls for one and half revolution. Name the curve. Draw tangent and normal to the curve at a point 35mm above the straight line and on the ascending side of the curve.			
	6	A circle of diameter 36mm rolls *inside* a circle of diameter 108mm. for one revolution without slipping. Trace the locus of a point on circumference of the circle of 36mm diameter. Name the curve. Also draw the tangent and normal at any point on the curve.			
7	**Basic Commands of CAD**		Introduction of the Draw toolbar like ARC,POLYLINE,ELLIPSE,RECTANGLE,POINTS,	**1**	**Lecture**

		HATCH,TEXT		
		Introduction to Modify Toolbar: MOVE, COPY,ROTATE,STRETCH,TRIM,BREAK,EDIT POLYLINE,CHAMFER,EXPLODE		
	Exercise : 6			
	Drawing different figure using above mentioned command(Figures are in Annex)		**3**	**Practice**
8	**Orthographic Projections**	Projection of an Object, Principal Views and Principal Planes of Projection, Four Quadrants and System of Projection, First angle and Third angle Projection, Difference between them and their advantages, Symbols of Projection, Projection of Points, Projection of Lines, Definition, True length and True Inclination of a Line.	**1**	**Lecture**
		Line Parallel to both the Planes, Line Parallel to one Plane and Perpendicular to Other plane, Line Parallel to one Plane and Inclined to Other, Line Inclined to both Horizontal and Vertical plane, Convention for Line Thickness		
	Exercise : 7		3	**Practice**
	1. A point is 35mm below HP, 20mm behind VP and 25mm behind the right profile plane. Draw its projections. 2. A line AB 60mm long has one of its extremities 20mm in front of VP and 15mm above HP. The line is inclined at 25^0 to HP and 40^0 to VP. Draw its top and front views. 3. A line PQ has its end P 15mm above HP and 10mm in front of VP. The end Q is 55mm above HP, and the line is inclined at 300 to HP. The distance between the end projectors of the line when measured parallel to the line of intersection of HP and VP is 50mm. Draw the projectors of the line and find its inclination with VP. 4. The mid point of a line AB is 60mm above HP and 50mm in front of VP. The line measures 80mm and inclined at 30^0 to HP and 45^0 to VP. Draw its projections. 5. The distance between the end projectors passing through the end points of a line AB is 40mm. The end A is 20mm above HP and a5mm infront of VP. The end B is 45mm in front of VP. The line AB appears as 65mm long in the front view. Complete the projections. Find the true length of the line and its inclinations with the HP and VP.			
9	**Advanced commands of Autoacd**		**1**	**Lecture**
	Exercise : 8		**3**	**Practice**
	Practice on the modify and Draw toolbar (Figure provided during the lab hour)			
10	**Projection of plane surface and solids**	Definition, True shape of a plane surface, Plane surface parallel to one of the Principal Planes and Perpendicular the other two, Plane Surfaces Perpendicular to one of the three Principle Planes and Inclined to other two, Plane Surfaces Inclined to all the three Principal Planes of Projection	**1**	**Lecture**
		Definition of Solids, Classification of Solids e.g. Polyhedrons, Prisms, Pyramids), Projection of Solids Placed in different positions, Axis of the Solid Perpendicular to HP ,Axis of the Solid Perpendicular to VP ,Axis of the Solid Perpendicular to HP and Parallel to VP ,Axis of the Solid Inclined to VP and Parallel to HP ,Axis of the Solid Inclined to both HP and VP ,Methods of Solving the Problems of Cubes, Cones, Prisms, Cylinders, Pyramids.		
	Exercise : 9			
	1. An equilateral triangular lamina of 30mm side lies on one of its sides on			

	HP. The lamina makes 45^0 with HP and one of its medians is inclined at 40^0 to the VP. Draw its projections. 2. A regular hexagonal lamina of 28mm side is resting on HP on one of its sides such that the side is perpendicular to the VP and the plane of the lamina is inclined to the HP at 45^0. the lamina is then rotated through 90^0 so that the side on the HP becomes parallel to the VP, still keeping the angle of the plane of the lamina with HP as 45^0. Draw the front and top views of the lamina held in its position. 3. A regular hexagon ABCDEF of 25mm side has its plane inclined at 45^0 to the HP and its diagonal FC parallel to the HP and inclined to VP at 45^0. Draw its projections when its side DE is nearest to the HP and 10mm above it. 4. A circular lamina, of 60mm diameter, is inclined at an angle of 600 to the HP, while a diameter of it is parallel to both the HP and VP. The center of the lamina is 50mm from the VP and 40mm from the HP. Draw the front and top views of the lamina held in the given position. 5. A cube of 30mm edge rest with one of its square faces on HP such that one of its vertical faces is inclined at 30^0 to the VP. Draw its projections. 6. An equilateral triangular prism 20mm side of base and 50mm long rests with one of its shorter edges on HP such that rectangular face containing the edge on which the prism rests is inclined at 30^0 to HP. The edge on which the prism rests is inclined at 60^0 to the VP. Draw its projections. 7. Draw the top and front views of a rectangular pyramid of sides of base 20mm*25mm and height 35mm when it lies with one of its triangular faces containing the longer edge of the base on HP. This longer edge containing the triangular face lying on HP is inclined at 60^0 to VP in the top view with the apex of the pyramid away from VP. 8. A cone of base 60mm diameter and axis 80mm long rests on HP with its axis inclined 45^0 and 30^0 with HP and VP respectively. Draw the top and front views of the cone.			
11	**Dimensioning on CAD**	Introduction, terminology, dimension style, linear dimension, aligned dimension, angular dimension, radius & diameter dimension, angular dimension, base line dimension	**1**	**Lecture**
	Exercise : 10			
	Practice on the dimensioning (Figure provided during the lab hour)		**3**	**Practice**
12	**Prepare the Exercise 3 and 5 in CAD**		**4**	**Lecture/ Practice**
13	Surface development	Methods of Development: Parallel Line Development, Radial Line Development, Triangulation Development, Approximate Development	1	**Lecture**
	Exercise : 11		3	**Practice**
	1. A vertical square prism 30mm sides , 60mm high having one of its rectangular faces leaning to the right at an angle of 300 to VP, is cut by a cutting plane perpendicular to VP and inclined at 60^0 to its axis. The cutting plane passes through the axis at the mid height of the prism. Develop the lower portion of the lateral surfaces of the prism. 2. A right regular square prism of 30 mm base edge and 60 mm height rests on its base such that its vertical faces are equally inclined to VP. It has a horizontal circular hole of 30 mm diameter drilled at the top of its axis through it such that the axis of the hole cuts both the diagonally opposite vertical edges. Develop the lateral surface of the prism. 3. A vertical hexagonal prism of 30mm side of base and axis 65mm long has one of its rectangular faces parallel to VP and nearer to it. A circular hole of 40mm diameter is drilled through the prism at right angles and is perpendicular to VP. Draw the development of prism showing the shape of the hole on it. 4. A vertical cylinder of 70mm diameter and 90mm high is cut by a section plane perpendicular to VP and inclined at 45^0 to the axis so as to pass through the top end of one of the extreme generators in the front view.			

	Draw the development of the lateral surface of the truncated cylinder providing a minimum length at the joint.		
14	**Prepare the Exercise 11 of Surface development CAD**	**4**	**Lecture/ Practice**
15	**Second Internal**		

TEXT BOOK

1. Gopalkrishna K.R., Engineering Drawing Vol. 1 & 2, Seventeenth edition, Subhash Publications, Bangalore 1996.

REFERENCE BOOKS

1. Laxminarayan V., Mathur M.L., A Textbook of Machine Drawing, Eighth edition, Jain Brothers, New Delhi, 1992.
2. Bhatt N.D., Machine Drawing, Sixteenth Edition, Charotar Book Stall, India, 1980.
3. Gill P.S., Engineering Drawing (Geometrical Drawing), Eleventh Edition, SK Kataria & Sons, Delhi, 2005(Reprint).

EDRG 102

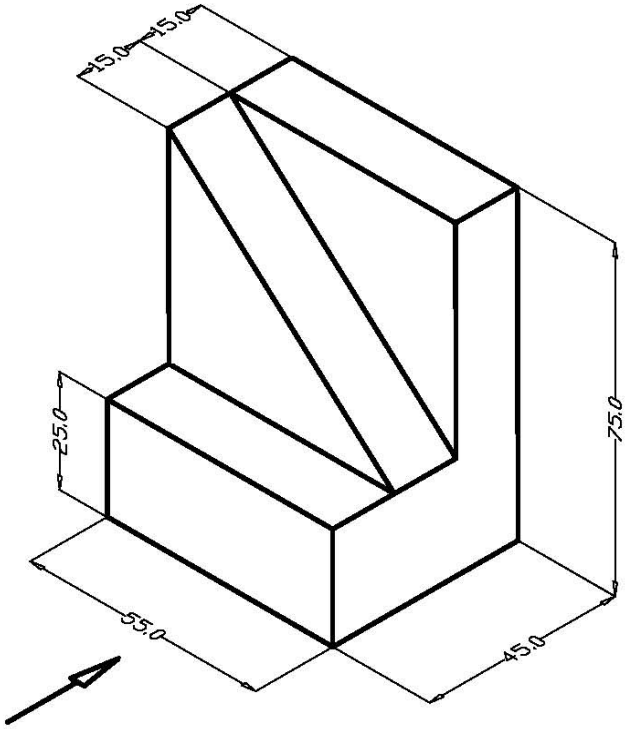
KATHMANDU UNIVERSITY
Department of Mechanical Engineering

Course: EDRG 102
Group: BE/BT/BPharm/BSc.

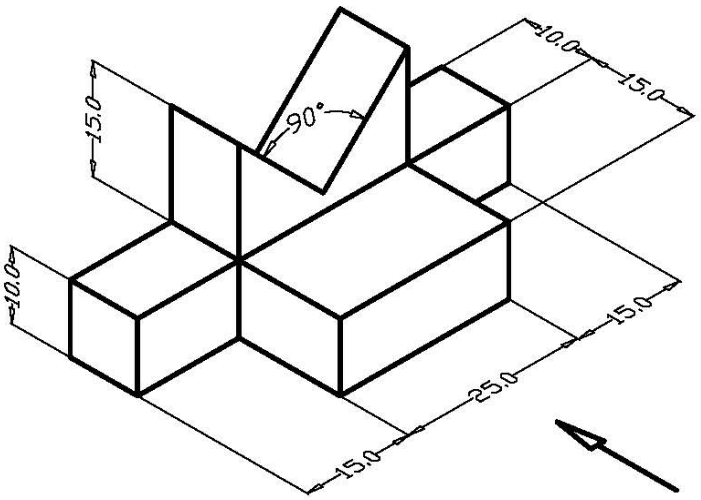
Year: I / II
Sheet No. 1

Draw the **Orthographic Views** of the objects shown and show all the dimensions. **Front View** is indicated by the arrow.
All Dimensions are in mm.

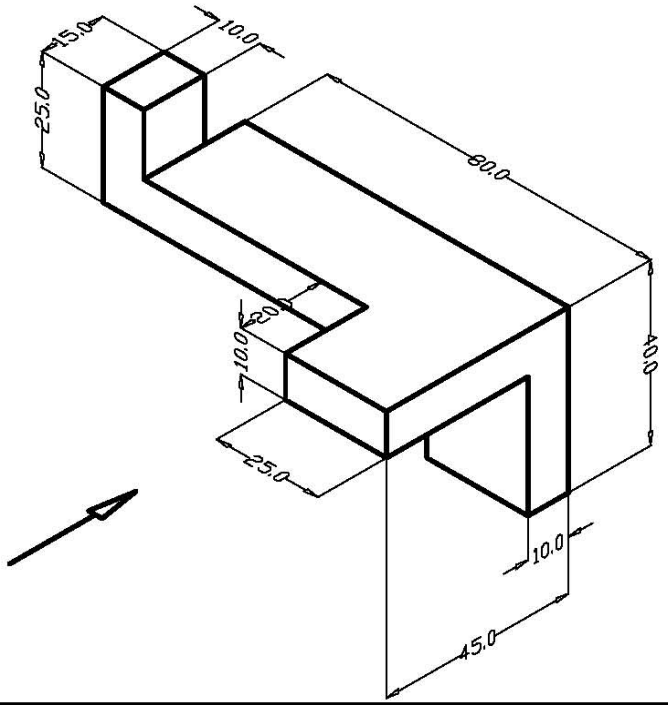
1. (i) FRONT VIEW (ii) TOP VIEW (iii) RIGHT SIDE VIEW



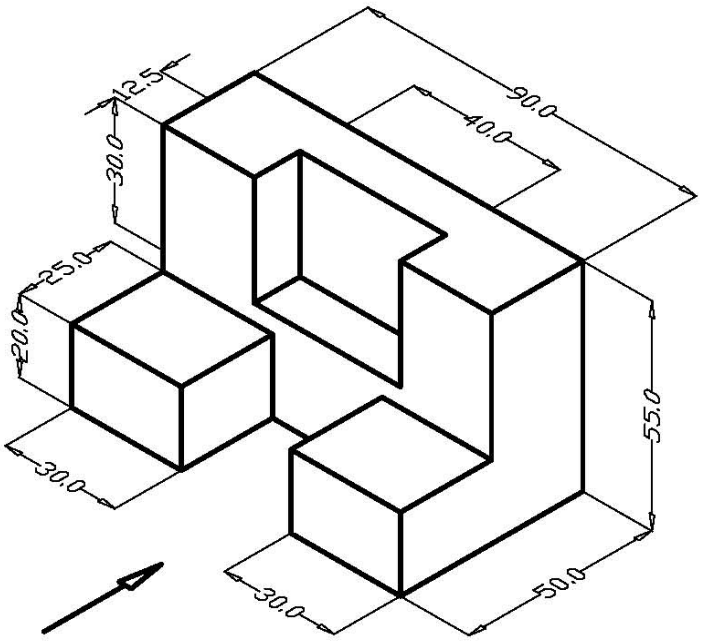
2. (i) FRONT VIEW (ii) TOP VIEW (iii) LEFT SIDE VIEW



3. (i) FRONT VIEW (ii) TOP VIEW (iii) RIGHT SIDE VIEW



4. (i) FRONT VIEW (ii) TOP VIEW (iii) RIGHT SIDE VIEW



KATHMANDU UNIVERSITY

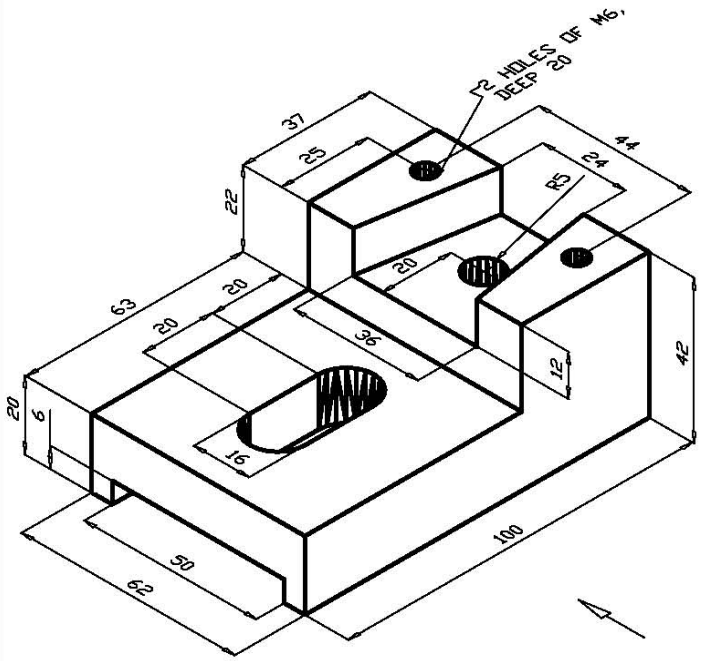
Department of Mechanical Engineering

Course: EDRG 102
Group: BE/BT/BPharm/BSc.

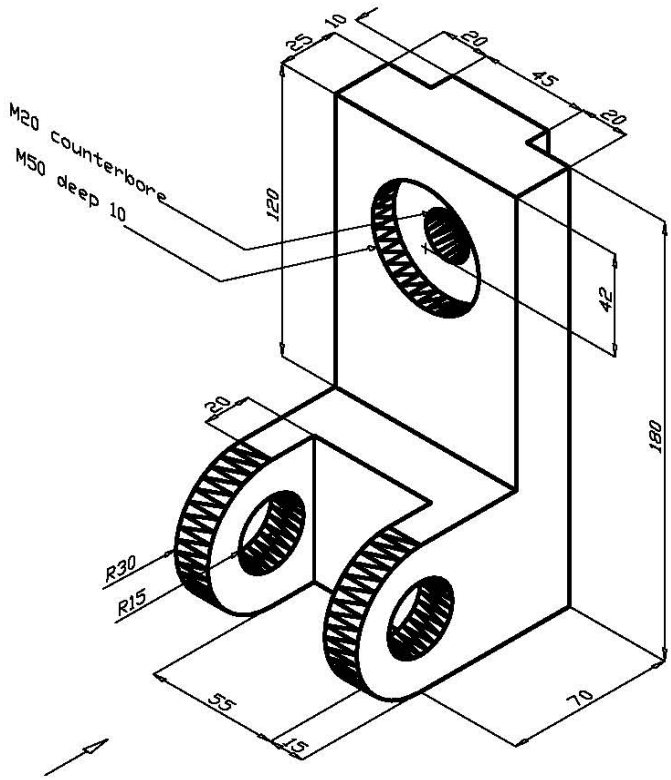
Year: I / II
Sheet No. 2

Draw the **Orthographic Views** of the objects shown and show all the dimensions. **Front View** is indicated by the arrow.
All Dimensions are in mm.

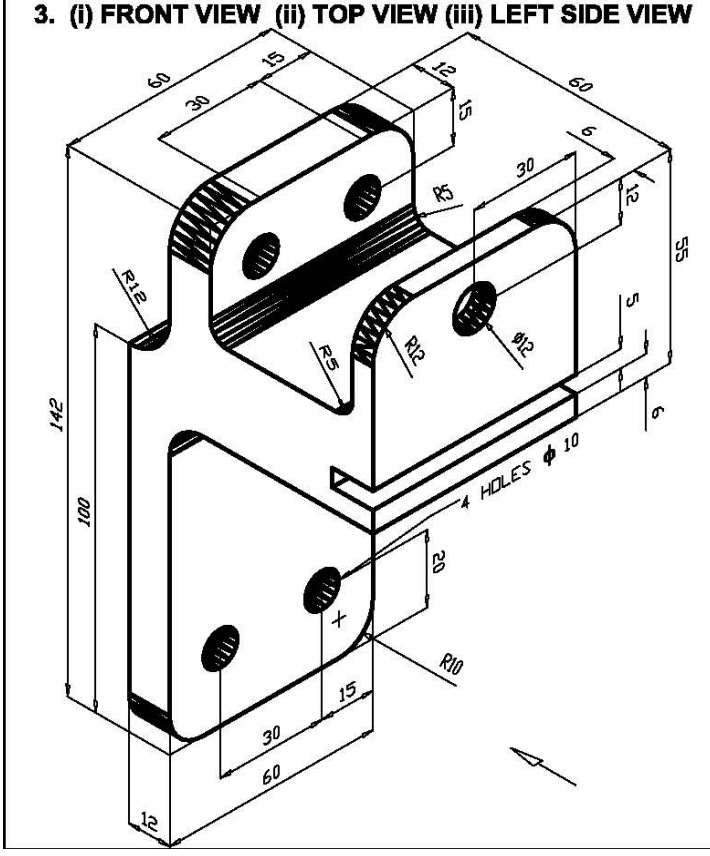
1. (i) FRONT VIEW (ii) TOP VIEW (iii) LEFT SIDE VIEW



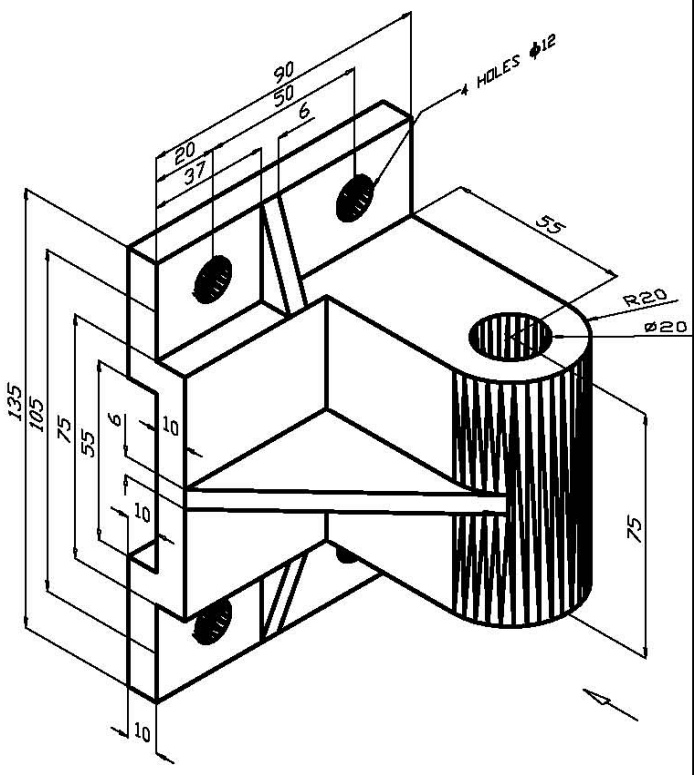
2. (i) FRONT VIEW (ii) TOP VIEW (iii) LEFT SIDE VIEW



3. (i) FRONT VIEW (ii) TOP VIEW (iii) LEFT SIDE VIEW



4. (i) FRONT VIEW (ii) TOP VIEW (iii) LEFT SIDE VIEW



KATHMANDU UNIVERSITY

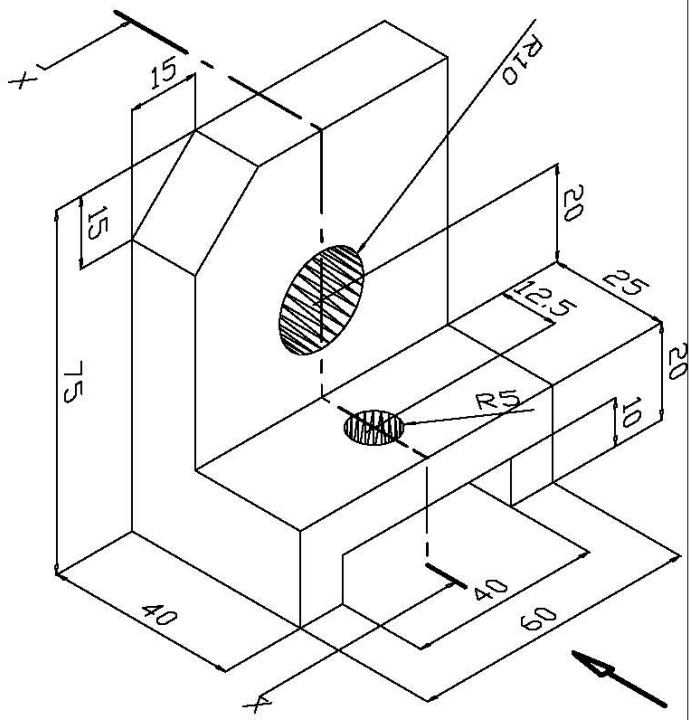
Department of Mechanical Engineering

Course: EDRG 102
Group: BE/BT/BPharm/BSc.

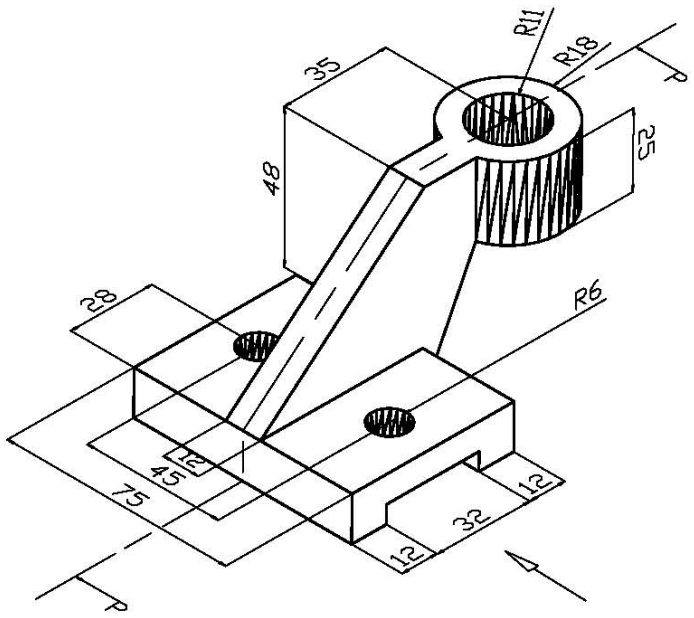
Year: I / II
Sheet No. 3

Draw the **Orthographic Views** of the objects shown and show all the dimensions. **Front View** is indicated by the arrow. All Dimensions are in mm.

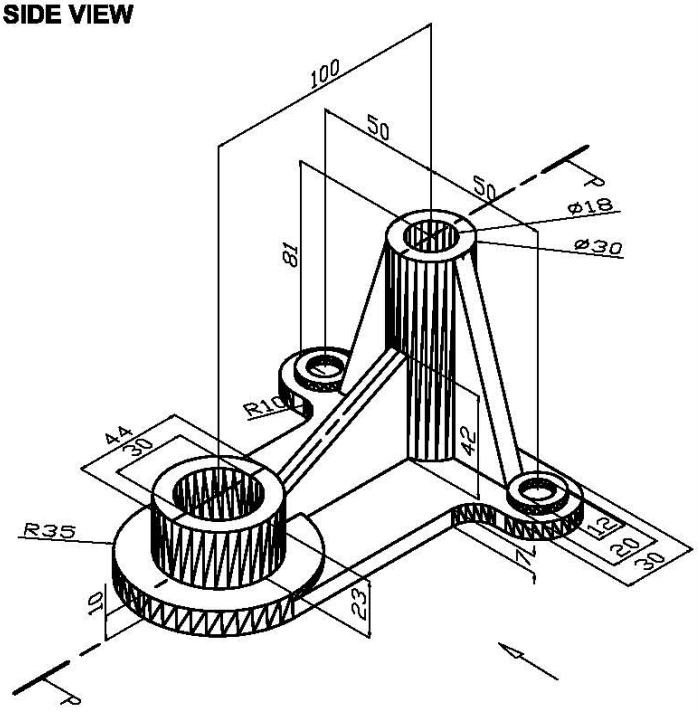
1. (i) FRONT VIEW (ii) TOP VIEW (iii) SECTIONAL LEFT SIDE VIEW



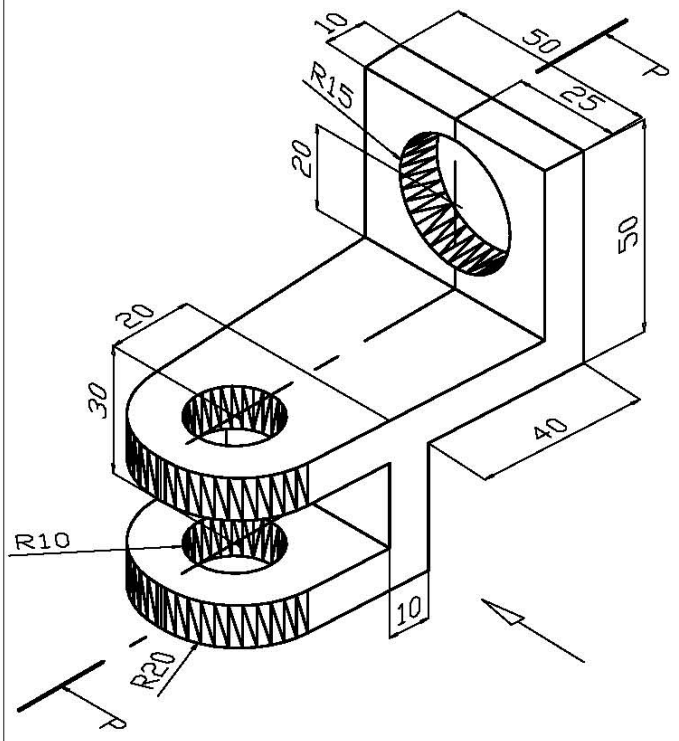
2. (i) SECTIONAL FRONT VIEW (ii) TOP VIEW (iii) LEFT SIDE VIEW



3. (i) SECTIONAL FRONT VIEW (ii) TOP VIEW (iii) LEFT SIDE VIEW



4. (i) SECTIONAL FRONT VIEW (ii) TOP VIEW (iii) RIGHT SIDE VIEW



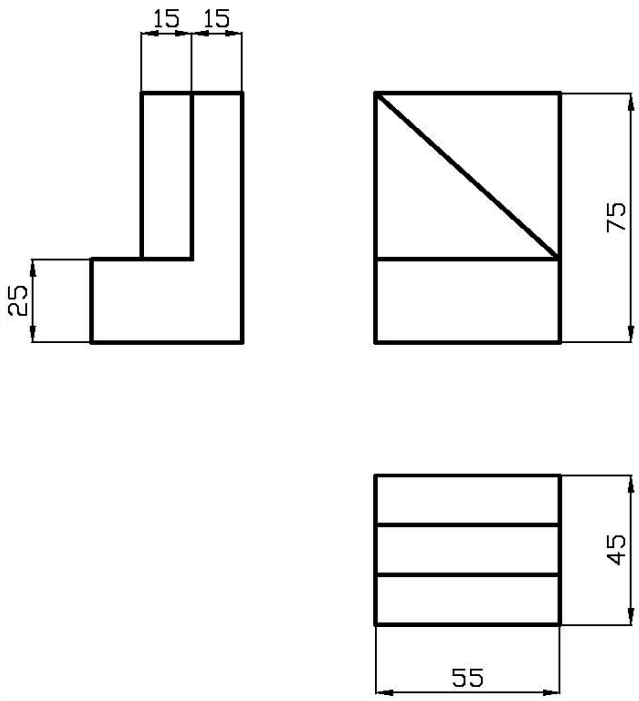
KATHMANDU UNIVERSITY
Department of Mechanical Engineering

Course: EDRG 102
Group: BE/BT/BPharm/BSc.

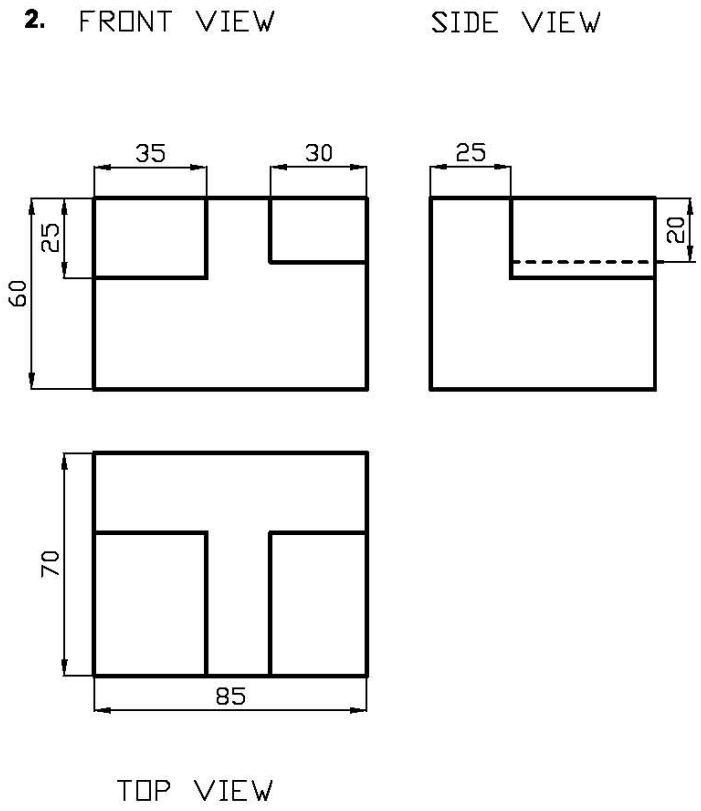
Year: I / II
Sheet No. 4

Draw the **Isometric Projections** of the Orthographic views shown and show all the dimensions.
All Dimensions are in mm.

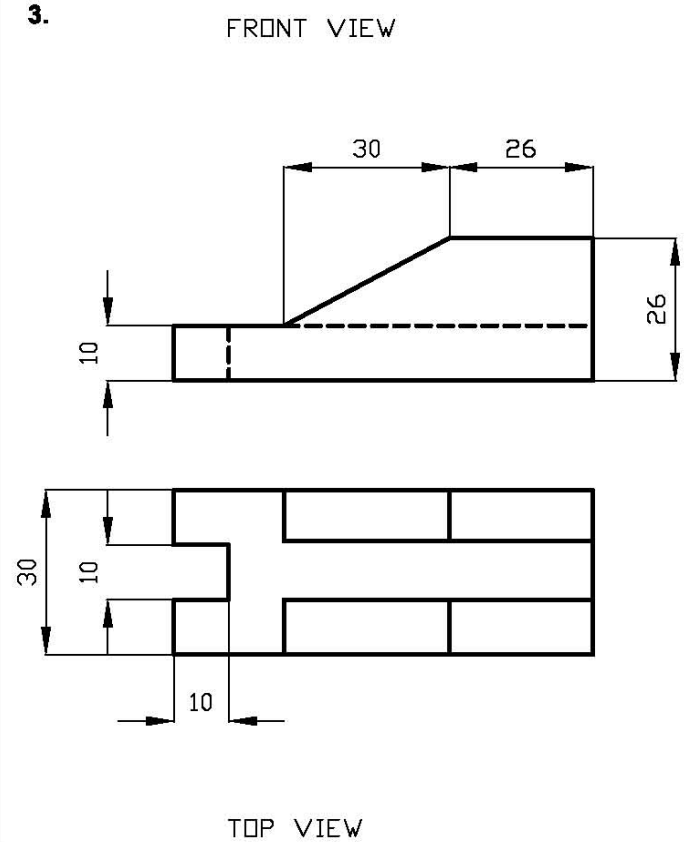
1.



2.



3.



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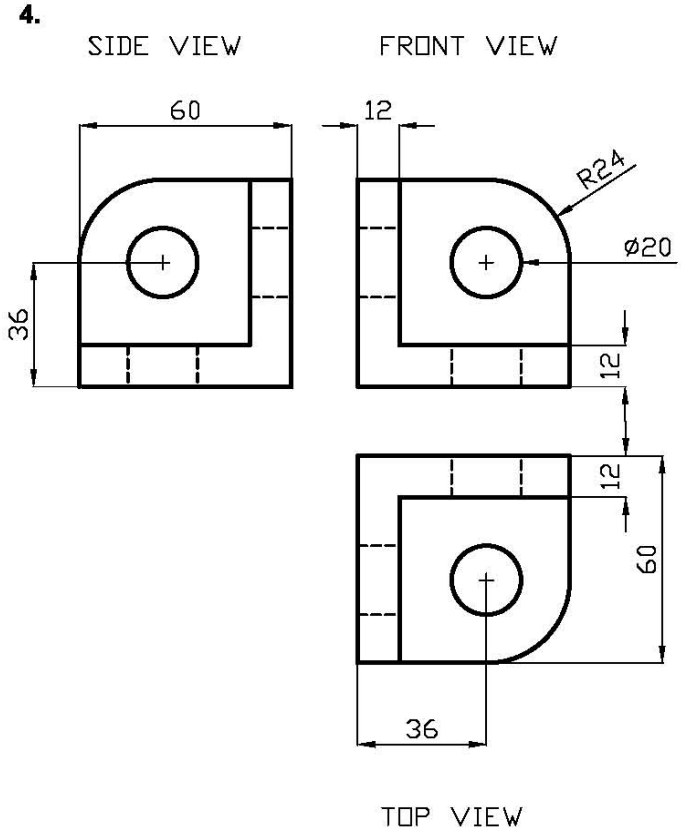


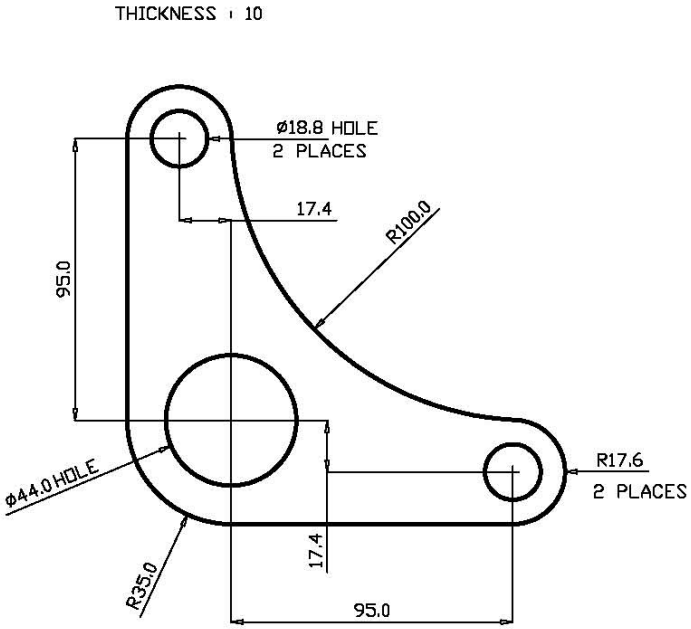
KATHMANDU UNIVERSITY
Department of Mechanical Engineering

Course: EDRG 102
Group: BE/BT/BPharm/BSc.

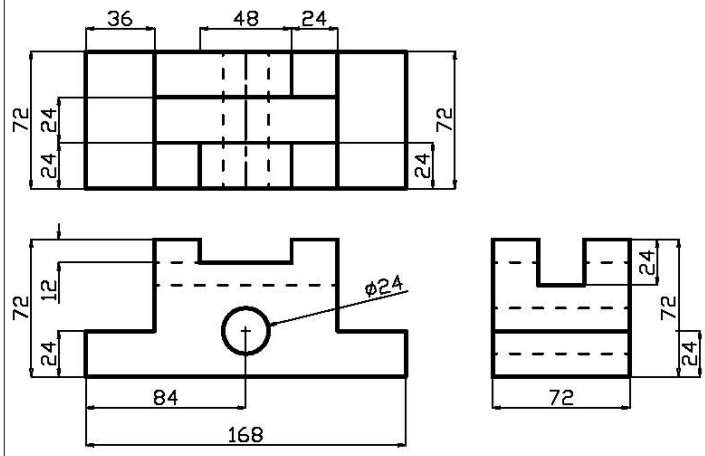
Year: I / II
Sheet No. 5

Draw the **Isometric Projections** of the Orthographic views shown and show all the dimensions.
All Dimensions are in mm.

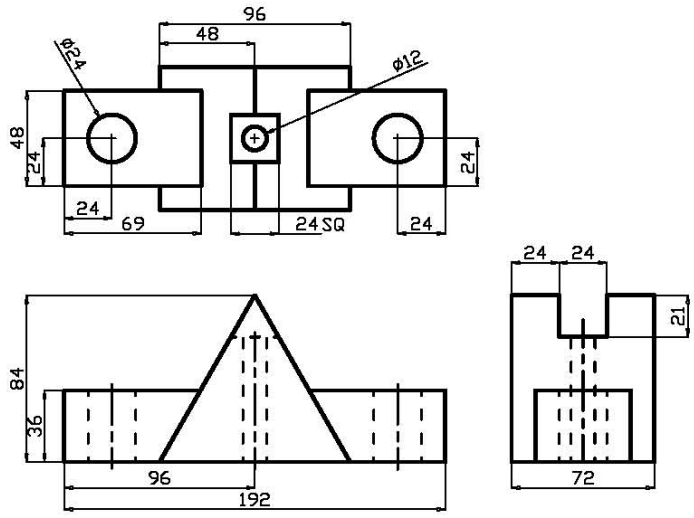
1.



2.



3.



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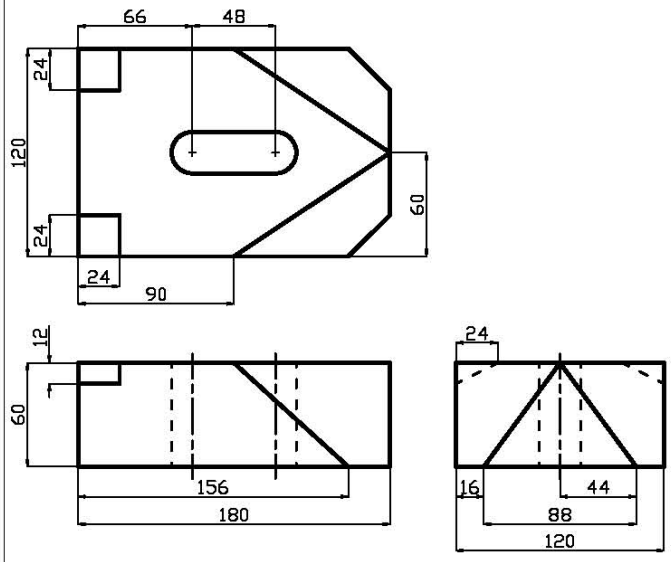

KATHMANDU UNIVERSITY
Department of Mechanical Engineering

Course: EDRG 102 **Year: I / II**
Group: BE/BT/BPharm/BSc. **Sheet No. 6**

Draw the riveted joints as mentioned in the following questions.

1. Draw 1:2 Scale, the top view and sectional front view of a double riveted lap joint with (i) chain and (ii) zig-zag riveting. The thickness of the plates is 9 mm. show at least three rivets in each row. Indicate all the dimensions and empirical proportions.

2. Draw 1:1 scale, the top view and sectional front view of a single riveted butt joint with (i) single cover plate (ii) double cover plate. The thickness of the plates is 9 mm. Show at least three rivets in each row. Indicate all dimensions and empirical proportions.

3. Draw to 1:1 scale the top view and sectional front view of double riveted butt joint with double cover plate with (i) chain riveting (ii) zigzag riveting. The thickness of the plates is 14 mm. indicate all the dimensions and empirical proportions.

KATHMANDU UNIVERSITY
Department of Mechanical Engineering

Course: EDRG 102 **Year: I / II**
Group: BE/BT/BPharm/BSc. **Sheet No. 6**

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1. Draw 1:2 Scale, the top view and sectional front view of a double riveted lap joint with (i) chain and (ii) zig-zag riveting. The thickness of the plates is 9 mm. show at least three rivets in each row. Indicate all the dimensions and empirical proportions.

2. Draw 1:1 scale, the top view and sectional front view of a single riveted butt joint with (i) single cover plate (ii) double cover plate. The thickness of the plates is 9 mm. Show at least three rivets in each row. Indicate all dimensions and empirical proportions.

3. Draw to 1:1 scale the top view and sectional front view of double riveted butt joint with double cover plate with (i) chain riveting (ii) zigzag riveting. The thickness of the plates is 14 mm. indicate all the dimensions and empirical proportions.

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Department of Mechanical Engineering

Course: EDRG 102 **Year: I / II**
Group: BE/BT/BPharm/BSc. **Sheet No. 7**

Draw Nuts & Bolts as mentioned in the following questions.

1. Draw the three views of a threaded hexagonal bolt 150 mm long, 24 mm diameter and a thread length of 60 mm with hexagonal nut. Indicate all the proportions and the actual dimensions

2. Draw the three views of a square headed bolt with a hexagonal nut. show the bolt head and the nut across the corner in the front view. The nut is screwed on the bolt. The bolt is 20 mm diameter, 120 mm long with a thread length of 50 mm. the end of the bolt is chamfered to 45 degrees.

3. Draw the view across flats and the axial view of a square head bolt and a square nut of size M20, bolt length 100 mm and thread length 60 mm.

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