INDUSTRIAL TECHNOLOGY

TECHNICAL DRAWING
LEVEL 9

Topic	Skills	Knowledge	Understanding	Attitude	Content	Materials	Methods/ Strategies	Evaluation	Area of Integration
Reduction and enlargement of plane figures to reduce plane figure by lengths of sides using the polar method.	- Reading skills. - How to construct plane figure. - How to do equal division - How to draw parallel lines.	- Know what is reduction. - state what is the polar method.	- Explain the procedure for reducing the plane figure.	Accuracy and neatness are extremely important.	Suppose the ratio is 1:3. Draw the plane figure. Select a point P (the pole) any distance away from the figure. Join P to the vertices and divide PA, the bottom most radial line into three equal parts. From A_1 draw A_1 D_1 parallel to AD, A_1 B_1 parallel to AB, B_1 C_1 parallel to BC and C_1 D_1 parallel to CD. A_1 B_1 C_1 D_1 is the required figure.		Demonstrate the method for the construction. Students practice step by step.	Set similar problems for additional practice.	Mathematics Building Technology

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To enlarge plane figures by lengths of sides using the polar method.	- Reading skills. - How to construct plane figures. - How to do equal division.	- know what is enlarge-ment, the Polar method.	- Analyse the given data. Explain the procedure for enlarging plane figure.	Neatness, clarity and accuracy.	Suppose the ratio is 5:3. Construct the figure (triangle ABC) Select a point P any distance outside the triangle ABC. Join P to the vertices A, B and C. and produce PC, PB and PA. Divide PA, the bottom most radial line into three equal parts. Draw A_1 C_1 parallel to AC, C_1 B_1 parallel CB and B_1 A_1 parallel to BA. A_1 B_1 C_1 is the required triangle.		Demonstration on the method for the construction.		Building Technology.

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To reduce a plane figure by lengths of sides using the direct method.	- Reading skills - How to construct plane figure	- state what is the direct method.	Explain the procedure for reducing the figure.	Accuracy and neatness are extremely important.	Suppose the ratio is 2:3. Construct the figure (pentagon ABCDE). From A draw the diagonals AC and AD of the pentagon. Divide the side AB into three equal parts. From B, draw B_1 C_1 parallel to BC, similarly C_1 D_1 parallel to CD and D_1 E parallel to DE. $A_1B_1C_1D_1E_1$ is the required figure.		Demonstrate the method for the construction.	Set similar problems for additional practice.	Building Technology Mathematics

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To enlarge plane figures by length of sides using the direct method.	- Reading skills - How to construct plane figures. - How to draw parallel lines.	- State what is direct method.	Explain the procedure for enlarging the figure.	Accuracy and neatness are extremely important.	Suppose the ratio is 4:3. Draw the figure (pentagon ABCDE) and from A draw diagonals AC, AD and AE. Divide the side AB into three equal parts. With center B and radius. B2 on AB mark off B4 along AB produced, thus giving the point B,. From B, draw B_1 C_1 parallel to BC, then C_1 D_1 parallel to CD, D_1 E_1 parallel to DE. A_1 B_1 C_1 D_1 E_1 is the required figure.		Demonstrate the construction step by step.	Give a test based on the construction.	Mathematics Building Technology.

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The Ellipse – Definition and parts.	Skills in writing and drawing.	Define the ellipse. List the parts of the ellipse. Identify the parts of the ellipse.	The ellipse is oval shaped.	Use the correct method of labeling diagrams.	Ellipse is the focus of a point moving so that the sum of the distances from any point on the curve to two fixed points called the foci is a constant. The parts of the ellipse are: the foci, the minor axis and the major axis.	Diagram showing the ellipse and the parts of the ellipse.	1. Display the diagram showing the ellipse. 2. Explain the definition of the ellipse. 3. Allow the students to write the definition. 4.Explain the parts of the ellipse. 5. Let the students draw and label the parts of the ellipse.	Ask the students to give the definition and parts of the ellipse.	Arts Mathematics

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Construction of Ellipse, Concentric Circle Method.	Skill in the use of the drawing instruments.	Define ellipse. Construct ellipse by concentric circle method. Identify the parts of ellipse Define concentric circle.	Procedure of constructing the ellipse by concentric circle method.	Use the appropriate types of lines to show construction and object lines.	Concentric circles are circles that are drawn from the same center. Constructing Ellipse: 1. Draw circles using the radius of the stated major and minor axis. 2. Divide into twelve equal parts. 3. Draw horizontal lines from the minor circle and vertical lines from the major circle. 4. Produce a smooth curve through intersections of vertical and horizontal lines to form the ellipse.				

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Construction of Ellipse, Trammel Method.	Skill in the use of pencil. Skill in marking out and measuring lines.	Construct the ellipse by the trammel method. State definition of ellipse.	There are more than one method of constructing the ellipse.	Measure accurately and label points.	Procedure: 1. mark out the major and minor axes. 2. Mark half the major and minor axis on a piece of stiff cardboard. 3. Place mark of major axis on minor axis and mark of minor axis on major axis. 4. Shift the strip to obtain various positions, keeping points on both axes. 5. Mark out each new position. 6. Connect points to form ellipse.	Strips of cardboard. Ruler and pencil.	1. Demonstrate how to mark out major and minor axis on strip of cardboard. 2. Allow the students to mark out points. 3. Demonstrate the process in marking the ellipse. 4. Allow the students to practice 5. Demonstrate how to draw the curve of ellipse. 6. Let the students practice.	Give exercise in constructing the ellipse by the trammel method.	

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Pictorial Drawing – Isometric.	Skill in constructing isometric axes.	List the methods of developing isometric drawing. Develop isometric drawings with sloping or non isometric lines.	Explain the difference between isometric and non-isometric lines.	Use the correct angles for isometric drawings.	Many objects have sloping lines. In isometric drawing, sloping surfaces appear as non-isometric lines. To draw them, locate the points found on the end of isometric lines and join them with straight lines.	Technical Drawing instruments .	1. Demonstrate the method of developing isometric drawings with sloping lines. 2. Explain how sloping lines are drawn on the isometric view. 3. Allow the students to practice the operations.	Give exercise on construction of isometric drawing with sloping lines.	

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Pictorial Drawing, Oblique.	Skills in the use of the drawing instruments.	Construct oblique drawing. Define oblique drawing.	Oblique drawings show one face in full view.	Use oblique drawing to show details that are difficult to read in other methods of projection.	Oblique drawings are started by drawing the face with the greatest irregularity of outline or contour, or the face with the longest dimension, faces front. The other faces are then lined in by working from the front face towards the back.	Technical Drawing instruments.	1. Demonstrate the procedure for constructing oblique drawing 2. Explain and demonstrate procedure step by step. 3. Allow the students to practice each step in construction.	Give exercise for students to construct oblique drawings.	

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Orthographic Projection, First Angle	Construction of first angle projection.	State the definition of orthographic projection Identify the planes of projection.	Explain the planes of projection. Explain first angle projection.	Use projection lines to transfer details from one view to the next.	In the angle projection of plans to the horizontal plane and elevations to the vertical planes, the objects is visualized as being inside a box whose walls and floor are planes to which the various views are projected.	Technical Drawing instruments	1. Explain and demonstrate how to project first angle. 2. Give simple solid and ask students to sketch first angle orthographic views. 3. Allow the students to do instrument dewing of sketches.	Exercise involving the construction of first angle projection.	Mechanical Engineering Technology.

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Orthographic Projection, Third Angle.	Drawing using instruments.	Define third angle projection. Identify third angle projection. Construct third angle projection.	Explain the arrangement of views in third angle projection.	Use the methods of projection when constructing orthographic views.	In third angle projection the object is placed in the third angle and the plan and elevations projected on to the planes which are visualized as being transparent, the object being viewed through them. When the planes forming the transparent box are opened out, the plan appears above the front elevation, whilst the end elevation are diagrams of the end nearest to the plane and not of the opposite end as in first angle.	Diagram showing the system of third angle projection. Technical Drawing chalkboard instruments.	1. Display chart showing projection of third angle. 2. Explain the position of the views. 3. Explain the planes of projection of third angle projection. 4. Demonstrate the construction of third angle projection. 5. give the students examples to practice.	Assignment on third angle projection.	

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Orthographic Projection, Three View Layout.	Skills in the use of lines and projection of views.	State the definition of first and third angle projection.	Views must be drawn in the middle or center of the paper.	Use the method for layout of three views when constructing first and third angle projection.	1. Space out the length of three views when constructing first and third angle projection. 2. Place the X'Y' lines in the center between the front elevation and the end elevation. 3. The height of the front elevation and the width of one plan, plus size 'A' taken from the size of the paper, divided by two, will give an equal margin at top and bottom. 4. Complete the layout in faint lines.	Diagram showing example of thee-view layout. Technical Drawing instruments.	1. Explain the principles of three view layout. 2. Display and explain diagram showing layout 3. Give example of solid to be laid out 4. demonstrate method to three-view layout. 5. Let the students practice operations.	Ask individual students to explain the procedure for three layout.	

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Construction of the circumscribed circle of a triangle.	Manipulating drawing instruments to: 1. draw triangles 2. bisect lines 3. draw arcs and circles.	Define 1. triangle 2. circumscribe	Follow the correct procedure in the construction of the circumscribed circle of a triangle.	Working neatly and accurately to construct the circumscribe circle.	A circumscribed circle includes a triangle and touches the vertices of the triangle. Procedure: Draw the triangle ABC with AB as the base and bisect any two sides e.g AC and BC. Extend the bisectors to intersect at O. With center O and radius of OA draw the circle required.	Draw equipment and instruments.	List the steps in the constructions of the circumscribe circle. Demonstrate each step and allow students to practice the steps.	Let students do exercise on the construction of the circumscribe circle.	Mathematics Building Technology Mechanical Engineering Technology.

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Construction of the inscribed circle of triangle.	Manipulating drawing instruments to: 1. draw triangle 2. bisect angles 3. draw arcs and circles.	Define 1. triangle 2. inscribed circle.	Follow the correct procedure in the construction of the inscribed circle of a triangle.	Working neatly and accurately to construct the inscribed circle.	An inscribed circle touches (is tangential to) each side of a triangle. Procedure: Draw the triangle ABC with AB as the base. Bisect two angles. Extend the bisectors to intersect at O With center O and radius the perpendicular distance to one side – draw the required circle.	Draw equipment and instruments.	List the steps in the construction of the inscribed circle. Demonstrate each step. Allow students to practice each steps.	Let students do exercises on the construction of the circum-scribe circle.	Mathematics Building Technology Mechanical Engineering Technology.

Topic	Skills	Knowledge	Understanding	Attitude	Content	Materials	Methods/ Strategies	Evaluation	Areas of Integration
Construction of the escribed circle of triangle.	Manipulating drawing instrument to: 1. draw triangle 2. bisect angles 3. draw arcs and circles.	Define 1. triangle 2. escribed circle.	Follow the correct procedure in the construction of the escribed circle of a triangle.	Working neatly and accurately to construct the escribed circle Procedure: Draw triangle ABC and extend two sides. Bisect the exterior angles. Let the bisectors intersect at O. With perpendicular distance to a side (radius), draw the required circle.	An escribed circle is constructed to touch one side of a triangle and other extended sides or extensions of other sides.	Drawing equipment and instruments.	List the steps in the construction. Demonstrate each step. Allow students to practice each step.	Let students do exercise on the construction of the escribed circle of a triangle.	Mathematics Building Technology Mechanical Engineering Technology.

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Construction of three circles in external contact.	Manipulating drawing instruments to: 1. draw lines 2. draw arcs 3. draw circles.	Define and identify A) tangent b) point of contact.	Follow the correct procedure in the construction of three circles in external contact. Recognize that circles in contact are tangential to each other.	Working neatly and accurately.	Circles in contact are circles which touch each other at only one point termed the point of contact Procedure: Draw large circle. Add the radius of this circle to those of the two other circles to obtain their centers. Use radius from each center to draw required circles.	Draw equipment and instruments.	List the steps in the construction. Demonstrate each step allow students to practice each step.	Let students do exercise on the construction of three circles in external contact.	Mathematics Building Technology Mechanical Engineering Technology.

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The Isometric Circle.	How to draw tangential arcs to form a neat isometric circle.	In two-dimensional drawing a circle is crated in square, whereas in three-dimensional drawing, an isometric circle represents a circle and is crated in a rhombus.	The students must say only the circle in isometric projection is elliptical in shape. Explain why the circle must be crated in a rhombus.	Neatness of drawing.	It is often required to draw circles or curved shapes isometrically since a circular face drawn isometrically is not a true circle. Special methods are used in representing circles on metric drawing. There are three general methods used for this purpose, they are: 1. American method. 2. Diagonal method. 3. The ordinate method		Let student draw the surface side of a box on the chalkboard. Point out to them that the box is a rectangle. Let them draw the box in isometric. Ask them the shape of the surface (side) point out to them the difference in angle. Draw a circle in a square on the chalkboard. Ask students what the square becomes in isometric. What happens to the circle. Discuss the steps on how to construct the isometric circle.		

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					The American method: - Draw the metric square that will contain the circle. - Join the longer diagonal. - From any vertex facing the longer diagonal, draw two straight lines to meet the point of the adjacent sides. - From the two of the smaller diagonals and the two points where the longer diagonal is cut, the isometric circle can be drawn.		Construct the circle on the sides of an isometric box and then colour the holes with black and the black with a bright colour	Exercise on drawing the isometric circle.	Art Woods Metals

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The Diagonal Method.	Sketching curve Transferring measurements accurately.	Identify the diagonals of square and rhombus. Identify the sides of the square which correspond to the sides of the rhombus.	Explain how the diagonal method is different from the American method.	Accuracy and neatness of drawing.	- Draw a square with sides equal to the diameter of the circle the construction required. - Draw in both diagonals - Draw two vertical lines to pass through where the circle cuts the diagonals. - Draw a rhombus with sides equal to the diameter of the circle required. - Draw in the diagonals.	Chart showing the construction of the isometric circle using the diagonal method.	Discuss the stages on how to construct the isometric circle. Let students follow the steps in the construction of the isometric circle.	Exercise on the construction of the isometric circle.	Art Woods Metals.

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					- From the square where the two lines passing through the diagonals reaching the sides of the square, take off the distance from the intersection to the vertex of the square. Transfer this distance to corresponding sides of the rhombus - From the points of intersection of the circle on the square, sketch a neat curve on the rhombus through the corresponding points from the square.				

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The Ordinate Method.	Sketching curve. Transferring measure-ments accurately.	Identify the ordinates from the circle which correspond to the ordinates on the rhombus.	Explain how the ordinate method can be compared to the diagonal method.	Accuracy and neatness of drawing.	- Draw the required circle. - Draw the horizontal and vertical diameters. - Divide the horizontal diameter into any suitable number of parts. - Draw ordinates through these points at 90° to the horizontal diameter. - Draw an isometric square with sides equal in length to the diameter of the circle. - Draw in the ordinates using the same division on the horizontal diameter.	Chart showing the construction of the isometric circle using the ordinate method.	Discuss the stages on how to construct the isometric circle using the ordinate method. Let students follow the steps in constructing the isometric circle.	Exercise on the construction of the isometric circle.	Art Woods Metals

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					- Where the ordinates touch the circle, take off these measurements and transfer them to the corresponding ordinates in the isometric square. - Sketch the isometric circle.				

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Scales Types of Scales.	Read scales. Use drawing instruments.	Identify R.F. and types of scales.	Calculate R.F. and distances.	Neatness clarity and accuracy.	Scales are of two types. There are: 1. plane 2. diagonal A scale of 1mm to 20mm expressed as ratio is 1:20. This ration expressed as a fraction is 1/20. The fraction 1/20 is called the representative fraction. It is called R.F. for short.		Let students sketch the blackboard on paper. Let them say what size of the blackboard is represented on the paper. Let them measure the blackboard and then using their own scale, draw the blackboard on the paper. Discuss types of scales and R.F.	What is R.F. Name the two types of scale. Using your own scale, draw, the cover of an exercise book.	Geography Mathematics

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The Plain Scale.	Using scales to measure objects.	Reading scales. Constructing scales.	Applying scales to large objects to have them suitably represented on paper.	Neatness clarity and accuracy.	To draw a plain scale 20mm to 1m, to read up to 4m in m and cm. 1. Draw a horizontal line to the required length (20mmX4=80mm). 2. Divide this line into four equal parts. 3. Draw vertical lines at each of these dividing points to suitable length and complete the rectangle. 4. Divide the end division on the left into ten equal parts. 5. The scale can now read in meters and centimeters.		Demonstrate each step to the students. Allow students to make a scale of their own.	Make a scale to show 40mm to 1m to read up to meters and centimeters.	Geography Mathematics