Federal Democratic Republic of Ethiopia
Ministry of Education

Basic Technical Drawing, Grade 11

2009

Grade 11 Basic Technical drawing Outcome

The 11th grade basic Technical drawing course will enable students to:

- understand the basic concepts of Technical drawing;
- develop accuracy, speed, neatness and visualization skill of technical drawing;
- apply basic principles and conventions for making technical drawing of an object.

Unit 1: Introduction to Technical drawing *(1period)*

Unit outcome: students will be able to

- Appreciate the contribution of graphical language (Drawing) in human civilization;
- Understand the basic concepts, purpose and areas/ professional disciplines of technical drawing.

Competencies	***Contents***	***Suggested activities***
Student will be able to: • define drawing in their own concepts; • write the role of drawing in human civilization; • explain how and when drawing is originated; • Distinguish the two classification of drawing;	***1. Introduction to basic Technical drawing*** *(1 period)* • Definition and History of drawing	• Ask students to identify the use of drawing around their school and out of the school. • give a clear clarification about drawing using models of different paintings, sign and marks, graphic art and posters. • Student should be Introduced the history of drawing by showing pictures of ancient Egyptians hieroglyphs. • Students should be asked to define drawing with their own understanding and then give the right definition of drawing. • discuss about the two distinct classification of drawing in related to real world practice
• describe the areas/ professional disciplines of technical drawing involves; • describe some important applications of technical drawing in every day life;	• Areas/ professional disciplines of Technical drawing	• student should clearly distinguish technical drawing from other arts and list areas/professional disciplines of technical drawing by class discussion.
• state the advantage of CADD in related to manual work;	• Technical drawing today Computer-Aided design drafting (CADD)	• Discuss and demonstrate the advantage and disadvantage of manual and AUTOCAD drawings,
• explain the educational value of technical drawing;	• Uses and educational value of Technical drawing	• students should understand the Uses and educational value of Technical drawing • arrange a visit to industrial drafting rooms, professional drafting training centers (engineering colleges, municipality drafting rooms etc)

Assessment

The teacher should assess each student's work continuously over the whole unit and compare it with the following description, based on the specific objectives, to determine whether the student has achieved the minimum required level.

Students at minimum requirement level
A student working at the minimum requirement level will be able to: Describe the role of drawing in human civilization, Distinguish the two classification of drawing, List the areas/professional disciplines of technical drawing, Describe the educational value of Technical drawing.

Students above minimum requirement level
Students working above the minimum requirement level should be praised and their achievements recognized. They should be encouraged to continue working hard and not become complacent.

Students below minimum requirement level
Students working below the minimum requirement level will require extra help if they are to catch up with the rest of the class. They should be given extra attention in class and additional lesson time at the end of the day or during breaks.

Unit 2: Basic Technical Drawing Equipments *(2 periods)*

Unit outcome: students will be able to

- understand the types, proper uses and applications of basic Technical drawing Equipments;
- Apply each basic technical drawing instruments and materials in making drawings.

Competencies	*Contents*	*Teaching and learning activities*
Students will be able to: • identify the difference between materials and instruments of drawing;	***2. Basic Technical drawing Equipments*** *(2 periods)* **2.1 Introduction** *(1 period)*	• Ask students to recall drawing materials which they know before • students should understand the difference between materials and instruments of drawing
• list the different types Technical drawing materials; • describe the purpose of each drawing materials; • state the different types of pencils, paper and Rapidograph; • use drawing materials properly on making drawing of objects in activities;	**2.2 Selection of drawing materials**	• student should recognize the types and purpose of drawing materials such as: Drawing paper, masking tape, drawing pencil, eraser, Rapidograph and tracing paper by chart or physical real object • students should identify the types of pencil, paper and Rapidograph….etc by real picture
• list the different types Technical drawing instruments; • describe the purpose of each drawing instrument; • Select drawing instruments in their specific application;	**2.3 Selection of drawing instruments** *(1 period)*	• discuss and demonstrate the type and purpose of drawing instruments such as: drawing board, dusting brush, T-square, set-square, scale, French curve, protractor, compass, divider and Template…etc by chart or physical real object

Competencies	*Contents*	*Teaching and learning activities*
• prepare oneself for making technical drawing; • arrange appropriate working area before starting drawing; • prepare the title block on drawing paper.	**2.4 Applications of basic Technical drawing Equipments**	• Demonstrate main steps help to prepare students in starting drawing such as cleaning instruments and one's hand surrounding working area then prepare Title block format • Discuss and show the application of basic technical drawing instruments

Assessment

The teacher should assess each student's work continuously over the whole unit and compare it with the following description, based on the specific objectives, to determine whether the student has achieved the minimum required level.

Students at minimum requirement level

A student working at the minimum requirement level will be able to: List the types of technical drawing materials & instruments, Describe the purpose of each Technical drawing materials & instruments, Identify the types of pencils, paper and radiograph, Show the proper uses of Technical drawing materials & instruments and prepare the title block on drawing paper.

Students above minimum requirement level

Students working above the minimum requirement level should be praised and their achievements recognized. They should be encouraged to continue working hard and not become complacent.

Students below minimum requirement level

Students working below the minimum requirement level will require extra help if they are to catch up with the rest of the class. They should be given extra attention in class and additional lesson time at the end of the day or during breaks.

Unit 3: Alphabet of lines *(1periods)*

Unit outcome: students will be able to

- understand the types of lines according to their purpose, weight and thickness in drawing;
- Apply alphabet of lines for making proper working drawings.

Competencies	***Contents***	***Teaching and learning activities***
Students will be able to: • list the types of lines; • explain the purpose and weight of alphabet of lines; • perform alphabet of lines in their weight and thickness; • use alphabet of lines on proper drawings.	***3. Alphabet of lines*** *(1 period)* • Introduction • purpose, weight and thickness of lines • Applications of alphabet of lines	• Ask students to list the types of lines they know before in related subjects. • student should be introduced about alphabet lines in related to other language • Discuss and demonstrate the types, purpose, weight, thickness and continuity of lines by using like charts and drawings. • show how to apply alphabets of line in working drawing such as On Title block, On working drawing like architectural and engineering And On map drawing and others • Allow students to perform practical activities on alphabet of lines, by class work or home work level.

Assessment

The teacher should assess each student's work continuously over the whole unit and compare it with the following description, based on the specific objectives, to determine whether the student has achieved the minimum required level.

Students at minimum requirement level
A student working at the minimum requirement level will be able to: List the types of lines used in Technical drawing, Explain the purpose and weight of each line and apply the proper weight & thickness of lines on working drawings.

Students above minimum requirement level
Students working above the minimum requirement level should be praised and their achievements recognized. They should be encouraged to continue working hard and not become complacent.

Students below minimum requirement level
Students working below the minimum requirement level will require extra help if they are to catch up with the rest of the class. They should be given extra attention in class and additional lesson time at the end of the day or during breaks.

Unit 4: Lettering *(2periods)*

Unit outcome: Students will be able to:

- distinguish the different lettering styles and guide lines for letter writing;
- understand the rules and principles of lettering;
- Execute (draw) the common Technical drawing lettering styles.

Competencies	***Contents***	***Suggested activities***
Students will be able to: • state the role of lettering in technical drawing; • identify the four type of lettering styles; • make Technical lettering, Single-strokes letters properly; • write/ draw vertical and inclined letters and numerals;	*4.* ***Lettering*** *(2 periods)* **4.1 Introduction** *(1 period)*	• Ask students the styles of letter which they know before • students should be introduced how information's can be convey in drawing and the types of lettering styles • discuss and demonstrate different lettering strokes using graph paper. • students should understand technical lettering called single-stroke letters, and Vertical and Inclined letters, numerals & Fractions • demonstrate the height of letters and numerals
• prepare guide lines properly for capital letters, lowercase letters, numerals and fractions; • draw letters and numerals with proportional height and width; • draw letters with proper spacing; • make proper space between words and sentences;	**4.2 Techniques of lettering** • Stability of letters	• Students should understand how to draw lettering guide lines for capital, lower case letters, numerals and fractions using model of letter drawn with proper space • Students should understand the concept of stability of letters to draw in the right shape
• compose letters in balance between words and sentences	• Composition of letters	• Discuss and demonstrate about composition of letters between words and sentences to create a balanced effect • student should keep Space between letters, words and sentences

Competencies	*Contents*	*Suggested activities*
• select proper types of pencils for lettering; • identify types of guide line devices and lettering guides;	**4.3 Pencil for lettering, lettering devices and Lettering guide** *(1 period)*	• Students should select the basic types of lettering pencils • Demonstrate the two basic types of lettering devices for guide lines and types of lettering guide like Templates.
• apply single stroke vertical gothic letters in Title block.	**4.4 Application of technical lettering** **(single stroke vertical gothic lettering)**	• Give exercise for students to perform practical activities on the mentioned topics by class work and assignment level

Assessment

The teacher should assess each student's work continuously over the whole unit and compare it with the following description, based on the specific objectives, to determine whether the student has achieved the minimum required level.

Students at minimum requirement level

A student working at the minimum requirement level will be able to: Describe the main purpose of lettering in drawing, Identify the types of lettering styles, Draw the universally applicable single stroke vertical Gothic letters with free-hand, Describe the techniques of lettering to draw free hand letters properly, Draw letter, words & sentences with proper spacing, Select proper types of pencils for lettering and identify types of guide line devices and lettering guides.

Students above minimum requirement level

Students working above the minimum requirement level should be praised and their achievements recognized. They should be encouraged to continue working hard and not become complacent.

Students below minimum requirement level

Students working below the minimum requirement level will require extra help if they are to catch up with the rest of the class. They should be given extra attention in class and additional lesson time at the end of the day or during breaks.

Unit 5: Geometrical construction *(12 periods)*

***Unit outcome**:* Students will be able to:

- understand different types of plane geometry and their basic elements;
- construct different types of geometrical figures;
- Apply methods and rules of construction for different types of geometrical shapes.

Competencies	***Contents***	***Suggested activities***
Students will be able to:	***5. Geometrical construction*** *(12 periods)*	
• Explain different types of geometrical elements;	**5.1 Introduction** *(2 period)*	• Ask students to discuss in group by identify the geometrical elements • Students should understand the aim of geometrical construction and how to formulate an accurate solution for geometrical figures. • Discuss and demonstrate about geometrical elements such as point, line, angle, plane and arc etc.
• construct different types of lines; • perform steps of bisect and trisecting straight line; • divide a line in to any number of equal parts without ruler; • construct angles with different methods; • perform steps of bisect and trisecting an angle; • divide an angle in to any number of equal parts; • transfer by coping angles for different places;	**5.2 construction of Point, line and angle**	• student should construct different lines and angles such as Draw parallel and perpendicular lines, Bisect and trisect a straight lines, Divide a line in to any number of equal parts, angle drawing (cord, sine and tangent method etc), Bisect and trisect an angle and Dividing and coping/ transferring an angle
• define polygon in their own words; • differentiate regular and irregular polygons; • construct triangles with	**5.3 Polygons***(4 periods)* • Regular and Irregular polygons • construction of regular polygons	• Discuss and demonstrate about polygon and differentiate regular and irregular polygons • Student should understand and construct about regular polygons like triangle, quadrilateral, pentagon etc.

Competencies	***Contents***	***Suggested activities***
different methods; • define quadrilateral in their own words; • construct different types of quadrilateral; • draw regular polygons using their specific method; • construct any type of regular polygon using general methods;		• Discuss and show the different construction method of regular polygons and give some practical activities.
• define circle in their own words; • construct circles using three points in space; • define tangency and tangent point; • construct tangent line and tangent curves to join circles and arcs; • apply different tangency concepts to real object drawing; • differentiate an Ellipse from other curved planes;	**5.4 Circles and Tangents** (*3 periods)* • Circle construction using three points • a line tangent to circles • An arc tangent to circles	• Discuss about circle and tangent and show the construction method circle with three points, and how to make/draw tangents and allow to do some practical activities • give exercise related to tangency about real objects like flower cap.
• construct an ellipse using different methods.	**5.5 Construction of Ellipse** *(3 periods)*	• student should understand construction method of ellipse and allow to do some practical activities on four center, Concentric circle and Parallelogram method • Allow students to practice on Geometrical construction in home work and class activities. • student should draw different patterns includes all types of geometrical elements

Assessment

The teacher should assess each student's work continuously over the whole unit and compare it with the following description, based on the specific objectives, to determine whether the student has achieved the minimum required level.

Students at minimum requirement level

A student working at the minimum requirement level will be able to: Define geometrical elements, draw a bisecting and trisecting straight lines, divide a line in to any number of equal parts with out rules, show the methods how to bisect & trisect an angle using compass, copy an angle to any other places with drawing steps, differentiate regular and irregular polygons, construct triangles and quadrilateral using different methods, construct regular polygons with specific and general methods, construct circle through three points not on a straight line on space, Construct tangent line and tangent curves to join circles and arcs, and Construct an ellipse using different methods.

Students above minimum requirement level

Students working above the minimum requirement level should be praised and their achievements recognized. They should be encouraged to continue working hard and not become complacent.

Students below minimum requirement level

Students working below the minimum requirement level will require extra help if they are to catch up with the rest of the class. They should be given extra attention in class and additional lesson time at the end of the day or during breaks.

Unit 6: Multi-view drawing *(25 periods)*

Unit outcome: Students will be able to

- Understand the basic principle of Multi-view drawing;
- Develop visualization skill to represent a 3D objects using the six principal views;
- Appreciate the convention and principle of describing the shape of an object.

Competencies	*Contents*	*Suggested activities*
Students will be able to: • Explain the importance of multi-view drawings; • define the concept of projection;	***6. Multi-view drawing*** *(25 periods)* **6.1 Introduction** *(1 periods)* **6.2 Projection** • Types of projection	• Students should understand the importance and application of multi-view drawings. • discuss and demonstrate the concept of projection and type of projection in short.
• Explain the concept orthographic projection; • Identify the three main projection planes; • Describe the methods of orthographic projection; • Prepare arranged view with first angle projection; • Prepare arranged view with 3rd angle projection;	**6.3 Orthographic projection** *(7 periods)* 6.3.1 plane of projection 6.3.2 Method of Orthographic projection - 1st angle projection - 3rd angle projection	• Give a brief explanation about orthographic projection • Students should know the three main projection planes and how they use in orthographic projection. • Discuss and demonstrate the 1st and 3rd angle projection methods and give some practical exercise. • Student should compare first and third angle projection
• Identify the six principal views; • Arrange the six principal views in 1st and 3rd angle projection methods; • Identify the common dimension of views; • analyze guide lines for	**6.4 The six principal views** *(10 periods)* 6.4.1 alignment of view 6.4.2 common dimension 6.4.3 Adjacent placement of views 6.4.4 Orientation of the object & choice of views	• Show the arrangement of the six principal views and explain the rules (like common dimension, adjacent placement of views and alignment of views)in both first and third angle of projection and give some practical activities. • Students should understand the guide lines orientation of objects and choice of views with their practical applications

Competencies	***Contents***	***Suggested activities***
orientation of an object and choose of views that most describe of an object • Laying out one-view, two view and three-view drawings; • Prepare the multi view drawing of an object;	6.4.5 One and two view drawing 6.4.6 Three-view drawing	• Explain, discuss and show the methods of one-view, two- view and three-view laying out methods • Allow students to practice on multi-view drawings, by home work and class work activities
• show hidden features of an object; • Apply the rule of precedence of line in view drawings.	6.4.7 Invisible lines and arcs 6.4.8 Precedence of lines	• Discuss and demonstrate hidden features of an object and applications of precedence of lines using examples and practical exercise
• identify normal, inclined, and oblique surface;	**6.5 Fundamental views of edges and surface** *(3 periods)* • Normal surface • Inclined surface • Oblique surface • curved surface	• Demonstrate and discuss about fundamental views of edges and surfaces such as: - normal surface - Inclined surface - oblique surface - curved surface - Hidden edge
• Apply visualization skills by solid and surface to multi-view drawings.	**6.6 Visualization and free hand multi-view sketching** *(4 periods)*	• Discuss and demonstrate by giving examples and exercises to develop visualization skill including surface identification, missing line and missing views and else.

Assessment

The teacher should assess each student's work continuously over the whole unit and compare it with the following description, based on the specific objectives, to determine whether the student has achieved the minimum required level.

Students at minimum requirement level

A student working at the minimum requirement level will be able to: Differentiate the method of orthographic projection, draw the shape of an object with 1st and 3rd projection, Arrange the six principal views in 1st & 3rd angle projections, Identify the three main projection plane and their common dimension, Determine the orientation of objects that help to choose views most descriptive, Laying out one view, two view and three-view drawing of objects, Prepare multi-view drawing of an object, Differentiate the three common surfaces and their projection, and Apply the rule of precedence of line in view drawing.

Students above minimum requirement level

Students working above the minimum requirement level should be praised and their achievements recognized. They should be encouraged to continue working hard and not become complacent.

Students below minimum requirement level

Students working below the minimum requirement level will require extra help if they are to catch up with the rest of the class. They should be given extra attention in class and additional lesson time at the end of the day or during breaks.

Unit 7: Pictorial Drawing *(25 periods)*

Unit outcome: Students will be able to

- Understand the basic principle of pictorial drawing;
- Recognize the different types of projection and the three types of pictorial drawing;
- Apply the principle of Axonometric, Oblique and perspective projection in describing 3D objects;
- Appreciate the importance of pictorial drawing to describe the shape of structures in today's world.

Competence	***Contents***	***Suggested activities***
Students will be able to: • Describe the concept of projection and its constituting elements; • Identify the types of pictorial drawing;	***7. Pictorial drawing*** **7.1 Introduction** *(1 period)* • Overview of the theory of projection • Types of pictorial drawing	• Ask students to define projection in their own understanding using the previous chapter knowledge. • Discussion and explain concept of projection and constituting elements using illustrations. • Student should identify the types of pictorial drawing by understanding the two classification of projection
• Define the principle of axonometric projection; • Identify the types of axonometric projection; • Choose appropriate position of isometric axis to describe the shape of an object;	**7.2 Axonometric projection** *(14 periods)* 7.2.1 Types of axonometric projection 7.2.2 Isometric drawing 7.2.3 Alternative position of isometric axis	• Students should understand the principle of axonometric projection and their classification and show the 3D image of an object in both types. • Discuss and demonstrate about Isometric drawing with different objects including Isometric axes and Reverse axis.
• Identify isometric and non isometric lines; • Identify the procedure of constructing angles are located in isometric drawing;	7.2.4 Lines and angles in isometric drawing • Isometric & non-isometric lines • angle in Isometric drawing	• Students should understand about Isometric lines, Non - isometric lines and Angles in isometric and apply in isometric drawing.
• Draw circles, arcs and irregular curves in isometric; • Apply offset location measurement in isometric	7.2.5 regular and Irregular curves in isometric • circle & arcs in isometric • Irregular curves in	• Students should understand about Circles, arcs and irregular curves in isometric and apply in isometric drawing.

Competence	*Contents*	*Suggested activities*
drawing; • Prepare the isometric drawing using box method and center line layout method; • Perform Isometric drawing of an object with its principle; • Describe the principle of oblique projection; • Identify the types of oblique drawing; • Identify the axis and position of objects in oblique drawing; • Apply method of construction of oblique drawing; • Draw circle and arcs in oblique drawing; • Perform Oblique drawing of an object with its principle; • Explain the terms of perspective drawing; • Identify the best location of station point, picture plane and vanishing point, • Show the location of	isometric • Offset location measurement 7.2.6 Isometric construction • box method • the center line layout method **7.3 Oblique projection** *(5 periods)* 7.3.1 Types of oblique drawing 7.3.2 position of axis in oblique drawing 7.3.3 oblique drawing construction 7.3.4 Circles in oblique drawing 7.3.5 Advantage of oblique drawing **7.4 Perspective projection** *(5 periods)* 7.4.1 definition of basic terms	• Discuss and demonstrate offset location measurement in isometric drawing by giving different example. • Student should understand the two construction method of Isometric drawing and they perform practically both methods. • Students should understand the principle and the types of oblique projection. • Discussion and demonstrate about Oblique drawing with different objects including Oblique axes and lines and the choice position of objects in oblique drawing. • hold class discussion on the advantage of oblique drawing and show the construction method of circle and arcs in oblique drawing and give some practical activities. • Students should explain the definition of basic elements, show the location of picture plane, station point, vanishing point and ground & horizon line • Hold class discussion on the principle and the types of perspective drawing and show the

Competence	*Contents*	*Suggested activities*
ground line and Horizon line; • Identify the three types of perspective drawing; • Apply the procedure of construction of objects in perspective; • Draw circles and arcs in perspective drawing; • Perform perspective drawings with its principle.	7.4.2 Location of picture plane & station point 7.4.3 Types of perspective drawing 7.4.4 construction of perspective drawing	construction method and applications of: - One point perspective (parallel perspective) - Two point perspective (Angular perspective) - Three point perspective. (oblique perspective) • Student should have some understanding about the method of construction of Circle and arcs in perspective drawing • Allow students to practice only on one point & some on two point perspective drawing, by assignment and class activities level.

Assessment

The teacher should assess each student's work continuously over the whole unit and compare it with the following description, based on the specific objectives, to determine whether the student has achieved the minimum required level.

Students at minimum requirement level

A student working at the minimum requirement level will be able to: Explain the types of projection system and its constituting elements, State the types of pictorial drawing and axonometric projection, Choose appropriate position of isometric axis to describe the shape of an object, Describe the procedure which angles are located in Isometric drawing, Draw circle, arcs and irregular curves in Isometric, Apply offset location measurement in Isometric drawing, Construct the isometric drawing using box method and center line layout methods, Perform isometric drawing of an object using its principle, State the types of oblique drawing, Explain about axis and position of objects in oblique drawing, Draw circles and arcs in oblique drawing, Construct oblique drawing of an object with its principle, Describe the advantage of oblique drawing from others, Explain the terms and best location of station and vanishing point, ground and horizon line, and picture plane, Describe the main purpose and three types of perspective drawing, State the procedure of construction of objects in perspective drawing, and Perform perspective drawing of objects with its principle.

Students above minimum requirement level

Students working above the minimum requirement level should be praised and their achievements recognized. They should be encouraged to continue working hard and not become complacent.

Students below minimum requirement level

Students working below the minimum requirement level will require extra help if they are to catch up with the rest of the class. They should be given extra attention in class and additional lesson time at the end of the day or during breaks.