

MINISTRY OF EDUCATION



Republic of Ghana

TEACHING SYLLABUS FOR TECHNICAL DRAWING (SENIOR HIGH SCHOOL 1 - 3)

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TEACHING SYLLABUS FOR TECHNICAL DRAWING

SENIOR HIGH SCHOOL (SHS)

RATIONALE FOR TEACHING TECHNICAL DRAWING

It is generally accepted that science, technology and manufacturing contribute to economic growth and development of nations. As a result, most developing nations soon after gaining independence introduced Technical and Vocational Education and Training (TVET) programmes in their school systems with the hope of accelerating industrialization to promote economic growth. The effort unfortunately did not yield the expected results. The 1987 Ghana educational reforms therefore initiated a move to strengthen Technical and Vocational Education and Training (TVET) with the introduction of pre-technical and pre-vocational skills at the Basic education level and the establishment of more Senior Secondary Technical Schools. However, the initiatives have also not had significant impact on skill acquisition and on the national level of production. As a result of this, one of the major aims of the new educational reform of 2007 is to give increased attention to TVET. In line with the new policy, a new subject titled Basic Design and Technology (BDT) has been introduced at the Junior High School in order to create national awareness and appreciation of the importance of design and technology in promoting technical education and industrialization. Further to this, TVET programmes at the Senior High School level have been reorganized and TVET courses revised. It is expected that the new impetus given to TVET programmes in the country will lead to rapid increase in the technical knowledge and skills of the young people of the country and will, in just a few years, directly contribute to increased production in the country. Technical Drawing is a universal language for effective communication in the manufacturing industry and is therefore an important subject in the TVET programme at the Senior High School. Technical Drawing offers pre-requisite knowledge and skills for a number of the technical and vocational areas of work. The subject helps students to develop spatial intelligence, imaginative and drawing skills so that they would become creative and help to solve many of the social, economic and professional problems that need designs before production.

GENERAL AIMS

This syllabus is designed to help the student to:

1. acquire the requisite knowledge, skills and attitudes for further technical education and training
2. develop positive attitudes towards the safe and economic use of drawing instruments, equipment and materials
3. develop imaginative thinking skills for solving social, economic and technological problems
4. develop positive attitudes and the requisite competence in the application of Technical Drawing for productive work.

SCOPE OF CONTENT

The syllabus is planned as an integration of knowledge and skills in Technical Drawing. It covers the following areas; plane geometry, solid geometry, graphical resolution of forces, Computer Aided Design (CAD), Building and Engineering Drawings.

PRE-REQUISITE SKILLS

The student should have good knowledge in Basic Design and Technology, English Language, Mathematics, Integrated Science, Social Studies and Information and Communication Technology (ICT)

ORGANIZATION OF THE SYLLABUS

The syllabus has been structured to cover the three years Senior High School (SHS) and consists of four sections with each section comprising a number of units. The sections are as follows: -

- Section 1: Plane Geometry
- Section 2: Solid Geometry
- Section 3: Building and Engineering Drawing I
- Section 4: Building and Engineering Drawing II

The syllabus for Year 1 -3 of SHS is presented as follows:

STRUCTURE AND ORGANIZATION OF THE SYLLABUS

YEAR ONE	YEAR TWO	YEAR THREE
<p>SECTION 1: PLANE GEOMETRY (Page 1)</p> <p>Unit 1: Introduction to Technical Drawing</p> <p>Unit 2: Drawing Instruments, Equipment and Materials</p> <p>Unit 3: Types of lines, lettering and numbering</p> <p>Unit 4: Division of lines</p> <p>Unit 5: Plain and diagonal scales</p> <p>Unit 6: Construction and Measurement of Angles</p> <p>Unit 7: Properties and Construction of Polygons</p> <p>Unit 8: Properties and Construction of Circles</p> <p>Unit 9: Properties and Construction of Tangents</p> <p>Unit 10: Inscribed, Circumscribed and Escribed Circles</p> <p>Unit 11: Enlargement and Reduction of similar Figures</p> <p>Unit 12: Conversion of equal areas of figures</p> <p>Unit 13: Construction of Conic Sections</p>	<p>SECTION 1: PLANE GEOMETRY (Page 11)</p> <p>Unit 1: Loci</p> <p>SECTION 2: SOLID GEOMETRY (Page 12)</p> <p>Unit 1: Pictorial Drawings: Oblique, Isometric and Perspectives</p> <p>Unit 2: Dimensioning</p> <p>Unit 3: Orthographic Projections</p> <p>Unit 4: Sectional views and True Shapes of cut Surfaces</p> <p>Unit 5: Surface Development</p> <p>Unit 6: Auxiliary Projections</p> <p>Unit 7: Introduction to Auto CAD</p> <p>SECTION 3 A: BUILDING DRAWING OPTION (Page 17)</p> <p>Unit 1: Freehand Sketching of Building Tools and Equipment</p> <p>Unit 2: British Standard (B.S.1192) Building Drawing</p> <p>Unit 3: Electrical and Plumbing Symbols</p> <p>Unit 4: Intersections of Straight and Curved Mouldings</p> <p>Unit 5: Construction of Arches</p>	<p>SECTION 4(A): BUILDING DRAWING OPTION (Page 24)</p> <p>Unit 1: Constructional Details of parts of Buildings</p> <p>Unit 2: Roofs</p> <p>Unit 3: Orthographic Projection of Buildings</p> <p>Unit 4: Working Drawings</p> <p>Unit 5: Forces and Framed Structures</p> <p>Unit 6: Shearing Forces and Bending Moment Diagrams</p> <p>Unit 7: Centre of Gravity of Forces acting on a body</p> <p>SECTION 4(B): MECHANICAL ENGINEERING DRAWING OPTION (Page 29)</p> <p>Unit 1: Dimensioning and Tolerances</p> <p>Unit 2: Sectioning</p> <p>Unit 3: Assembly Drawings</p> <p>Unit 4: Working Drawings</p> <p>Unit 5: Forces and Framed Structures</p> <p>Unit 6: Shearing Forces and Bending Moment Diagrams</p> <p>Unit 7: Centre of Gravity of Forces acting on a body</p>

YEAR ONE	YEAR TWO	YEAR THREE
	<p>SECTION 3 B MECHANICAL ENGINEERING OPTION (Page 20) Unit 1: Freehand Sketching of Engineering Tools and Equipment Unit 2: British Standard (B.S. 308): Engineering Drawing Unit 3: Conventional Representations of Fasteners and Locking Devices Unit 4: Conventional Representations of Welded and Riveted Joints</p>	

TIME ALLOCATION

Time allocation for Technical Drawing is as follows where each period is 40 minutes.

Year	No. of periods per week	No. of teaching weeks/year	Total periods in a year	Total hours in a year
1	6	36	216	144
2	6	36	216	144
3	6	24	144	96
Total	18	108	576	384

SUGGESTIONS FOR TEACHING THE SYLLABUS

Read this section very carefully to be able to follow the sequence of steps and processes prescribed for effective teaching and learning. Teachers should identify resource persons who will assist them to teach some of the topics they may find difficult to teach. Classroom activities should be supplemented with field trips to workshops and drawing offices in industries in the community. The school should acquire some vital items for teaching this subject and should also form good relationship with relevant organizations in the community where students could be taken periodically for observation and practical work.

General Objectives

General Objectives have been listed at the beginning of each Section. The general objectives specify the skills and behaviours the student should acquire after learning the units of the section. Read the general objectives very carefully before you start teaching the section. After teaching all the units of the section, go back and read the general objectives again to be sure you have covered the objectives adequately in the course of your teaching.

Sections and Units: The syllabus has been planned on the basis of Sections and Units. Each year's work is divided into sections. A section consists of a fairly homogeneous body of knowledge within the subject. Within each section are units. A unit consists of a more related and homogeneous body of knowledge and skills.

The syllabus is structured in five columns: Units, Specific Objectives, Content, Teaching and Learning Activities and Evaluation. A description of the contents of each column is as follows:

Column 1 - Units: The units in Column 1 are divisions of the major topics of the section. You are expected to follow the unit topics according to the linear order in which they have been presented. However, if you find at some point that teaching and learning in your class will be more effective if you skipped to another unit before coming back to the unit in the sequence, you are encouraged to do so.

Column 2 - Specific Objectives: Column 2 shows the Specific Objectives for each unit. The specific objectives begin with numbers such as 1.3.5 or 2.2.1. These numbers are referred to as "Syllabus Reference Numbers". The first digit in the syllabus reference number refers to the section; the second digit refers to the unit, while the third digit refers to the rank order of the specific objective. For instance, 1.3.5 means: Section 1, Unit 3 (of Section 1) and Specific Objective 5. In other words, 1.3.5 refers to Specific Objective 5 of Unit 3 of Section 1. Similarly, the syllabus reference number 2.2.1 simply means Specific Objective number 1 of Unit 2 of Section 2. Using syllabus reference numbers provides an easy way for communication among teachers and other educators. It further provides an easy way for selecting objectives for test construction. Let's say for instance, that Unit 2 of Section 2 has five specific objectives: 2.2.1 - 2.2.5. A teacher may want to base his/her test items/questions on objectives 2.2.3 and 2.2.4 and not use the other three objectives. In this way, a teacher would sample the objectives within units and within sections to be able to develop a test that accurately reflects the importance of the various skills taught in class.

You will note also that specific objectives have been stated in terms of the student i.e., *what the student will be able to do after instruction and learning in the unit*. Each specific objective, hence starts with the following, "The student will be able to." This in effect, means that you have to address the learning problems of each individual student. It means individualizing your instruction as much as possible such that the majority of students will be able to master the objectives of each unit of the syllabus.

Column 3 - Content: The "content" in the third column of the syllabus presents a selected body of information that the teacher will need to use in teaching a particular unit. In some cases, the content presented is quite exhaustive. In some other cases, the teacher could add more information to the content presented. In a few cases the content space has been left blank. The teacher should, as much as possible, add to the information provided by reading from books and other sources.

Column 4 -Teaching and Learning Activities (T/LA): T/LA activities that will ensure maximum student participation in the lessons are presented in column 4. Try to avoid rote learning and drill-oriented methods and rather emphasize participatory teaching and learning, and also emphasize the cognitive, affective and

psychomotor domains of knowledge in your instructional system wherever appropriate. You are encouraged to re-order the suggested teaching and learning activities and also add to them where necessary in order to achieve optimum student learning.

As we have implied already, the major purpose of teaching and learning is to make students able to apply their knowledge in dealing with issues both in and out of school. A suggestion that will help your students acquire the habit of analytical thinking and the capacity for applying their knowledge to problems is to begin each lesson with a practical problem. Select a practical problem for each lesson. The selection must be made such that students can use knowledge gained in the previous lesson and other types of information not specifically taught in class. At the beginning of a lesson, state the problem, or write the problem on the board. Let students analyze the problem, suggest solutions etc., criticize solutions offered, justify solutions and evaluate the worth of possible solutions. There may be a number of units where you need to re-order specific objectives to achieve such required effects. The emphasis is to assist your students to develop analytical thinking and practical problem solving techniques. You are encouraged to use teaching aids, visits and resource persons for effective delivery of lessons.

Column 5 - Evaluation: Suggestions and exercises for evaluating the lessons of each unit are indicated in Column 5. Evaluation exercises can be in the form of oral questions, quizzes, class assignments, essays, structured questions, project work etc. Ask questions and set tasks and assignments that will challenge your students to apply their knowledge to issues and problems in technical drawing and that will engage them in developing solutions, and developing positive attitudes as a result of having undergone instruction in this subject. The suggested evaluation tasks are not exhaustive. You are encouraged to develop other creative evaluation tasks to ensure that students have mastered the instruction and behaviours implied in the specific objectives of each unit. For evaluation during class lessons, determine the mastery level you want students to achieve in their answers and responses. If for instance, you take 80% as the mastery level, ensure that each student's answer to questions asked in class achieves this level of mastery.

Lastly, bear in mind that the syllabus cannot be taken as a substitute for lesson plans. It is therefore, necessary that you develop a scheme of work and lesson plans for teaching the units of this syllabus.

PROFILE DIMENSIONS

Profile dimensions describe the underlying behaviours or abilities students are expected to acquire as a result of having gone through a period of instruction. Each of the specific objectives in this syllabus contains an action verb that specifies the type of learning or skill that the student should acquire by the end of the instructional period. A specific objective as follows: The student will be able to describe ...etc. contains an action verb "describe" that indicates what the student will be able to do after teaching and learning have taken place. Being able to "describe" something after the instruction has been completed means that the student has acquired "knowledge". Being able to explain, summarize, give examples, etc. means that the student has understood the lesson taught. Similarly, being able to develop, plan, construct, etc. means that the student has learnt to create, innovate or synthesize knowledge. Each of the action verbs in the specific objectives of the syllabus describes the behaviour the student will be able to demonstrate after the instruction. "Knowledge", "Application", etc. are dimensions that should be the prime focus of teaching, learning and assessment in schools.

As already stated, profile dimensions describe the underlying behaviours for teaching, learning and assessment. In Technical Drawing, the three profile dimensions that have been specified for teaching, learning and testing are:

Knowledge and understanding	30%
Application of Knowledge	70%

Each of the dimensions has been given a percentage weight that should be reflected in teaching, learning and testing. The weights, indicated on the right of the dimensions, show the relative emphasis that the teacher should give in the teaching, learning and testing processes. Combining the three dimensions in the teaching and learning process will ensure that Technical Drawing is taught and studied not only at the cognitive level, but will also lead to the acquisition of the expected level of practical skills in the subject.

Knowledge and Understanding (KU)

Knowledge	The ability to: remember, recall, identify, define, describe, list, name, match, state principles, facts and concepts. Knowledge is simply the ability to remember or recall material already learned and constitutes the lowest level of learning.
Understanding	The ability to: explain, describe, summarize, translate, rewrite, paraphrase, give examples, generalize, estimate or predict consequences based upon a trend. Understanding is generally the ability to grasp the meaning of some material that may be verbal, pictorial, or symbolic.

Application of Knowledge (AK)

Ability to use knowledge or apply knowledge, as implied in this syllabus, has a number of learning/behaviour levels. These levels include application, analysis, innovation or creativity, and evaluation. These may be considered and taught separately, paying attention to reflect each of them equally in your teaching. The dimension “Use of Knowledge” is a summary dimension for all four learning levels. Details of each of the four sub levels are as follows:

Application	The ability to: Apply rules, methods, principles, theories, etc. to concrete situations that are new and unfamiliar. It also involves the ability to produce, solve, operate, demonstrate, discover, etc.
Analysis	The ability to: Break down material into its component parts; to differentiate, compare, distinguish, outline, separate, identify significant points, etc. recognize unstated assumptions and logical fallacies; recognize inferences from facts, etc.
Innovation/Creativity	The ability to: Synthesize or put parts together to form a new whole. It involves the ability to combine, compile, compose, devise, suggest a new idea or possible ways, plan, revise, design, organize, create, and generate new solutions. The ability to create or innovate is the highest form of learning. The world becomes more comfortable because some people, based on their learning, generate new ideas, design and create new things.
Evaluation	The ability to: Appraise, compare features of different things and make comments or judgments, contrast, criticize, justify, support, discuss, conclude, make recommendations etc. Evaluation refers to the ability to judge the worth or value of some materials, ideas etc., based on some criteria and standards. Evaluation is a constant decision making activity. We generally compare, appraise and select throughout the day. Every decision we make involves evaluation. Evaluation is a high level ability just as application, analysis and innovation or creativity since it goes beyond simple knowledge acquisition and understanding.

Lastly, bear in mind that the syllabus cannot be taken as a substitute for lesson plans. It is therefore, necessary that you develop a scheme of work and lesson plans for teaching the units of this syllabus.

FORM OF ASSESSMENT

It is important that both instruction and assessment be based on the profile dimensions of the subject. In developing assessment procedures, try to select specific objectives in such a way that you will be able to assess a representative sample of the syllabus objectives. Each specific objective in the syllabus is considered a criterion to be achieved by the student. When you develop a test that consists of items based on a representative sample of the specific objectives taught, the test is referred to as a “Criterion-Referenced Test”. In many cases, a teacher cannot test all the objectives taught in a term, in a year, etc. The assessment procedure you use i.e. class tests, homework, projects and examinations must be developed in such a way that it will consist of a sample of the important objectives taught over a period.

The examples below show the recommended examination structure for Technical Drawing. The structure consists of End of Term Examination and School Based Assessment.

Structure of End of Programme Examination:

This examination shall consist of two (2) papers both of which should be taken.

Paper 1: (Objective/Geometrical Drawings)

This shall be of 2½ hours duration consisting of two sections: A and B.

Section A: Shall consist of 40 compulsory multiple choice items for 40 marks and will last 1 hour. The section will be in two parts, I and II.

Part I: Shall consist of 30 questions numbered 1 – 30 and will be on general principles, techniques, uses of plane and solid geometry.

Part II: Shall consist of two alternatives: IIA (Building Drawing) and IIB (Engineering Drawing). Each alternative shall consist of 10 questions numbered 31 – 40. Candidates may answer the questions in either Part IIA or IIB.

Section B: Shall consist of 5 questions on plane and solid geometry and force diagrams. It will carry 60 marks and will last 1½ hours. Candidates shall be expected to answer 3 questions.

Paper 2: (Building/Engineering Drawing)

This shall be of 2½ hours duration consisting of two Sections: A and B:

Section A: Shall consist of 3 questions requiring sketches of objects, components and tools used in the building and engineering industries. Candidates shall be required to answer two questions: Question 1 and any other one for 30 marks.

Section B: Shall consist of two questions: One each on Building Drawing and Engineering Drawing. Candidates shall be required to answer either of the two questions for 70 marks.

The table on the next page shows the composition and manner in which the two test papers should be administered. The SBA could be considered separately. The SBA can be marked out of 100, 200 or any number and scaled down to 30% before grading.

Distribution of Examination Paper Weights And Marks

Dimensions	Paper 1		Paper 2		Total Marks	% Weight of Dimension	
	A		B	A			B
	Part I	Part II		(Sketches)			(Drawing)
Knowledge and Understanding						30	
Application of Knowledge						70	
Total Marks	30	10	60	30	70		
% Contribution of Exam papers	40		60	100		200	100

GUIDELINES ON SCHOOL BASED ASSESSMENT

A new School Based Assessment system (SBA) will be introduced into the school system in 2011. The new SBA system is designed to provide schools with an internal assessment system that will help schools to achieve the following purposes:

- Standardize the practice of internal school-based assessment in all Senior High Schools in the country
- Provide reduced assessment tasks for subjects studied at SHS
- Provide teachers with guidelines for constructing assessment items/questions and other assessment tasks
- Introduce standards of achievement in each subject and in each SHS class
- Provide guidance in marking and grading of test items/questions and other assessment tasks
- Introduce a system of moderation that will ensure accuracy and reliability of teachers' marks
- Provide teachers with advice on how to conduct remedial instruction on difficult areas of the syllabus to improve class performance.

The arrangements for SBA may be grouped in categories as follows: Folio preparation, Project, Mid-Term Examination, Group Exercise, and End of Term Examinations.

1. Folio Preparation: These are tasks assigned to students to be completed in extended time. Folio preparation may include the following:
 - i) Specific Designs
 - ii) Investigative Study and Field visit reports.

2. Project: This will consist of a selected topic to be carried out by groups of students for a year. Segments of the project will be carried out each term toward the final project completion at the end of the year,

The projects may include the following:

 - i) experiment
 - ii) investigative study (including case study)
 - iii) practical work assignment

A report must be written for each project undertaken.

3. Mid-Term Test: The mid-term test following a prescribed format will form part of the SBA

4. Group Exercise: This will consist of written assignments or practical work on a topic(s) considered important or complicated in the term's syllabus

5. End-of-Term Test: The end –of-term test is a summative assessment system and should consist of the knowledge and skills students have acquired in the term. The end-of-term test for Term 3 for example, should be composed of items/questions based on the specific objectives studied over the three terms, using a different weighting system such as to reflect the importance of the work done in each term in appropriate proportions. For example, a teacher may build an End-of-Term 3 test in such a way that it would consist of the 20% of the objectives studied in Term 1, 20% of objectives studied in Term 2 and 60% of the objectives studied in Term 3.

NOTE: The teacher will use the Cumulative Record Form or the Anecdotal Record format in observing individual students and write reports on them for the purpose of the SBA.

GRADING PROCEDURE

To improve assessment and grading and also introduce uniformity in schools, it is recommended that schools adopt the following WASSCE grade structure for assigning grades on students' test results.

Grade A1:	80 - 100%	-	Excellent
Grade B2:	70 - 79%	-	Very Good
Grade B3:	60 - 69%	-	Good
Grade C4:	55 - 59%	-	Credit
Grade C5:	50 - 54%	-	Credit
Grade C6:	45 - 49%	-	Credit
Grade D7:	40 - 44%	-	Pass
Grade D8:	35 - 39%	-	Pass
Grade F9:	34% and below	-	Fail

In assigning grades to students' test results, you are encouraged to apply the above grade boundaries and the descriptors which indicate the meaning of each grade. The grade boundaries i.e., 60-69%, 50-54% etc., are the grade cut-off scores. For instance, the grade cut-off score for B2 grade is 70-79% in the example. When you adopt a fixed cut-off score grading system as in this example, you are using the criterion-referenced grading system. By this system a student must make a specified score to be awarded the requisite grade. This system of grading challenges students to study harder to earn better grades. It is hence a very useful system for grading achievement tests.

Always remember to develop and use a marking scheme for marking your class examination scripts. A marking scheme consists of the points for the best answer you expect for each question, and the marks allocated for each point raised by the student as well as the total marks for the question. For instance, if a question carries 20 marks and you expect 6 points in the best answer, you could allocate 3 marks or part of it (depending upon the quality of the points raised by the student) to each point, hence totalling 18 marks, and then give the remaining 2 marks or part of it for organisation of answer. For objective test papers you may develop an answer key to speed up the marking.

RECOMMENDATIONS TO THE TECHNICAL DRAWING TEACHER

1. Technical Drawing Teachers must ensure that drawing instruments and materials are readily available for use in order to promote effective teaching and learning
2. Technical Drawing Teachers must insist on students using drawing instruments (**NOT MATHEMATICAL SET**), medium-sized set squares, drawing board A2 (420 x 594) mm with T-square and approved drawing paper A3 during Technical Drawing lessons.
3. Students must be encouraged to use French Curves where applicable in Technical Drawing lessons.
4. Students must be encouraged to read Drawing Office Practice for Architects and Builders BS 1192 (Metric)
5. Students must be encouraged to read Engineering Drawing Practice (BS 308A and BS 308B)

NOTE: Students must Not be ALLOWED to enter any Technical Drawing lesson without the items listed in 2.

RECOMMENDED INSTRUMENTS, EQUIPMENT AND MATERIALS FOR TECHNICAL DRAWING

1. A2 sized Drawing Board (450 x 594)mm
2. T-square for A2 Drawing Board
3. A-2 and A-3 Drawing Sheets
4. Medium-sized set squares (45° and 60°)
5. French Curves (set)
6. Rule
7. Pair of Clips
8. Protractor
9. Drawing instruments (NOT MATHEMATICAL SET)
10. Computers and accessories (minimum of twenty) for drawing class in every school.

NOTE: Each school should set aside a special classroom for drawing. The drawing room should be equipped with tables, chairs and at least twenty computers.

SENIOR HIGH SCHOOL – YEAR 1

SECTION 1

PLANE GEOMETRY

General objectives: The student will:

1. recognise the importance of Technical Drawing.
2. develop effective habits for safe use of drawing instruments, equipment and materials.
3. acquire skills and techniques in handling drawing instruments, equipment and materials correctly.
4. acquire knowledge and skills in plane geometry.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 1 INTRODUCTION TO TECHNICAL DRAWING	The student will be able to: 1.1.1 explain Technical Drawing. 1.1.2 state reasons for Technical Drawing in designing. 1.1.3 describe how to use Technical Drawing in the manufacturing industry. 1.1.4 practise good working habits.	Technical Drawing: is a universal language made up of lines as forms of alphabets, words and sentences. Reasons for Technical Drawing in designing. The use of Technical Drawing in the manufacturing industry: Characteristics of working drawings. Working drawings are accurate measurements. It shows measurements or parts of products or an item. Good working habits in the drawing office. Keep work table clean and neat	Discuss the importance of Technical Drawing in groups. Discuss the idea of designing to solve problems with students. Assist students to discuss the reasons for learning Technical Drawing. Discuss how to use Technical Drawing in industry. Note: Discussions should include the characteristics and components of working drawings. Demonstrate good working habits to students and assist them to discuss few examples. Students to discuss reasons for maintaining good working habits.	Students to explain Technical Drawing Students to identify specific problems that require designing for improvement. State the importance of Technical Drawing to the industry. Students to demonstrate good working habits.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 2 DRAWING INSTRUMENTS, EQUIPMENT AND MATERIALS	<p>The student will be able to:</p> <p>1.2.1 identify the various drawing instruments, equipment and materials.</p> <p>1.2.2 state the uses of the drawing instruments, equipment and materials.</p> <p>1.2.3 use drawing instruments, equipment and materials correctly.</p>	<p>Identification of drawing instruments, equipment and materials: drawing board, T-square, set squares (60⁰ and 45⁰), protractor, compasses, eraser, pencils, drawing papers, dividers, scale rule and french curves.</p> <p>Care and maintenance of drawing instruments, equipment and materials.</p> <p>Use of drawing instruments.</p> <p>Correct use of drawing instruments, equipment and materials.</p>	<p>Display the various drawing instruments, equipment and materials for students to observe.</p> <p>Discuss care and maintenance of drawing instrument.</p> <p>Discuss uses of drawing instruments, equipment and materials with students.</p> <p>Demonstrate the correct use of each drawing instruments, equipment and materials and assist students to practice.</p>	<p>Students to state names of various drawing instruments, equipment displayed.</p> <p>Students to explain how to care for and maintain drawing instruments, equipment and materials.</p> <p>Students to use drawing instruments, equipment and materials correctly for drawing geometrical shapes.</p>

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 3 TYPES OF LINES, LETTERING AND NUMBERING	<p>The student will be able to:</p> <p>1.3.1 identify the various types of lines.</p> <p>1.3.2 state the application of each line.</p> <p>1.3.3 draw types of lines correctly.</p> <p>1.3.4 differentiate between perpendicular and parallel lines.</p> <p>1.3.5 construct perpendicular and parallel lines.</p> <p>1.3.6 distinguish between lower and upper case letters.</p> <p>1.3.7 write lower and upper case letters.</p> <p>1.3.8 write numbers 0 to 9 correctly.</p>	<p>Identification of lines (outline, construction line, dimension line, centre line, hidden line, cutting plane and broken lines)</p> <p>Lines and their applications or uses.</p> <p>Drawing Types of lines.</p> <p>Perpendicular and parallel lines.</p> <p>Construction of perpendicular and parallel lines.</p> <p>Upper and lower case letters.</p> <p>Writing of numbers 0 to 9.</p>	<p>Illustrate and discuss the features of types of lines with students.</p> <p>Discuss the application of each type of line with students.</p> <p>Illustrate the appropriate techniques of drawing types of lines and assist students to practise.</p> <p>Illustrate how to draw parallel and perpendicular lines correctly without using drawing instruments and assist students to practise.</p> <p>Illustrate how to construct parallel and perpendicular lines with drawing instruments and assist students to practise.</p> <p>Using charts, discuss the differences between upper and lower cases of lettering.</p> <p>Illustrate how to letter in upper and lower cases and assist students to practise.</p> <p>Illustrate how to write numbers and assist students to practice.</p>	<p>Students to draw each type of line.</p> <p>Students to state the application of each line.</p> <p>Students to draw objects using different types of lines and their conventions.</p> <p>Students to draw perpendicular and parallel lines without using instruments.</p> <p>Students to construct perpendicular and parallel lines using drawing instruments.</p> <p>Students to differentiate between upper and lower case letters.</p> <p>Students to write upper and lower case letters correctly.</p> <p>Students to write numbers 0-9.</p>

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 4 DIVISION OF LINES	The student will be able to: 1.4.1 bisect given lines correctly. 1.4.2 trisect a given line. 1.4.3 divide lines into a number of equal parts. 1.4.4 divide a line into given proportion and ratios. 1.4.5 apply division of lines in scale construction, enlargement and reduction.	Bisection of lines. Trisection of lines using a pair of compasses and set-squares. Division of lines into a number of equal parts. Division of lines into given proportions and ratios. Application of division of lines in scale construction, enlargement and reduction.	Illustrate how to bisect lines and assist students to practise. Illustrate how to trisect a given line using a pair of compasses and 60° set-square. Illustrate how to divide a line into number of equal parts and assist students to practise. Illustrate how to divide a line into given proportions and ratios by using drawing instruments and assist students to practise. Guide students to apply the principles of division of lines where required (scale construction, enlargement, reduction and other applications).	Students to bisect a given length of line correctly. Students to trisect a given line with 60° set square correctly. Students to divide a given line into equal parts. Students to divide a given line into proportions and ratios correctly.
UNIT 5 PLAIN AND DIAGONAL SCALES	1.5.1 state reasons for using scales in drawing. 1.5.2 express a scale as a representative fraction. 1.5.3 construct plain and diagonal scales. 1.5.4 apply the scales correctly.	Reasons for using plain and diagonal scales (i.e. proportional and precision drawings). Representative fraction of scales. Construction of plain and diagonal scales. Application of scales in measurement.	Group students to discuss the reasons for using plain and diagonal scales. Discuss and demonstrate a representative fraction as a ratio or a fraction with the numerator as a unit. Students to do activities to convert given scales to representative fraction. Illustrate the principles for constructing plain scales. Discuss the limitations of plain scale. Illustrate the principles for construction of diagonal scale and assist students practice constructing plain and diagonal scales. Guide students to use the scales in producing a given figure.	Students to list examples of applications of division of lines. Students to state reasons for using plain and diagonal scales. Students to give examples of areas where plain and diagonal scales are used. Students to convert a given scale to representative fraction. Students to construct plain and diagonal scales and read them correctly. Students to use the scales in drawing plane figures.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 6 CONSTRUCTION AND MEASUREMENTS OF ANGLES	<p>The student will be able to:</p> <p>1.6.1 identify different types of angles.</p> <p>1.6.2 construct given angles.</p> <p>1.6.3 bisect given angles.</p> <p>1.6.4 trisect given angles.</p> <p>1.6.5 construct given angles using scales of chord.</p> <p>1.6.6 measure angles with protractor.</p>	<p>Definition and identification of angles: acute, right, obtuse and reflex.</p> <p>Construction of angles of given values.</p> <p>Bisection of angles.</p> <p>Trisection of angles.</p> <p>Construction of angles: using scales of chord.</p> <p>Correct measurement of angles using the protractor.</p>	<p>Discuss different types of angles with students and assist them to discuss their differences.</p> <p>Illustrate how to construct given angles and assist students to practise.</p> <p>Illustrate how to bisect given angles using drawing instruments and assist students to practise.</p> <p>Using drawing instruments, illustrate how to trisect an angle and assist students to practise.</p> <p>Illustrate the principles for constructing angles using scales of chord for students to practise.</p> <p>Guide students to measure given angles correctly by using the protractor.</p>	<p>Students to discuss the different types of angles</p> <p>Students to construct various types of angles.</p> <p>Students to bisect given angles using drawing instruments.</p> <p>Students to trisect given angles correctly using drawing instruments.</p> <p>Students to construct angles using scales of chord.</p> <p>Students to draw horizontal lines, measure and draw specific angles from points on the lines.</p>

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 7 PROPERTIES AND CONSTRUCTION OF POLYGONS:	<p>The student will be able to:</p> <p>1.7.1 define polygon.</p> <p>1.7.2 identify by names different polygons, triangles, quadrilaterals.</p> <p>1.7.3 State the characteristics of polygons.</p> <p>1.7.4 construct various types of triangles.</p> <p>1.7.5 Construct various types of quadrilaterals.</p> <p>1.7.6 construct regular polygons of given sizes.</p> <p>1.7.7 construct irregular polygons.</p>	<p>Polygons are plane figures with many sides and faces.</p> <p>Identification of different types of polygons and their names.</p> <p>Characteristics of polygons. Polygons has more equal faces and sizes. It can be regular and irregular.</p> <p>Construction of triangles. (isosceles, right-angled, scalene equilateral etc.)</p> <p>Construction of quadrilaterals (square, rectangle, rhombus, parallelogram, trapezium etc.)</p> <p>Construction of other regular polygons of given sizes including quadrilaterals. (pentagon, hexagon, heptagon, octagon, nonagon, decagon)</p> <p>Construction of irregular polygons with given properties.</p>	<p>Group students to discuss polygons.</p> <p>Use charts to show different types of polygons.</p> <p>Group students to discuss the characteristics of polygons.</p> <p>Illustrate how to construct the various types of triangles and assist students to practise.</p> <p>Illustrate how to construct the various types of quadrilaterals and assist students to practise</p> <p>Illustrate various methods of construction of polygons and assist students to practise.</p> <p>Illustrate with examples the construction of irregular polygons and assist students to practise.</p>	<p>Students to define polygon.</p> <p>Students to state the number of interior angles of selected polygons.</p> <p>Students to state the minimum and maximum sizes of polygon.</p> <p>Students to construct given triangles.</p> <p>Students to construct given quadrilaterals.</p> <p>Students to construct specific regular polygons.</p> <p>Students to construct irregular polygons.</p>
UNIT 8 PROPERTIES AND CONSTRUCTION OF CIRCLES	<p>1.8.1 identify various parts and properties of a circle.</p> <p>1.8.2 construct a given circle.</p>	<p>Parts of a circle and its properties.</p> <p>Construction of circles with given properties e.g. radius and three points.</p>	<p>Using charts, guide students to discuss the parts and properties of a circle.</p> <p>Illustrate the construction of a circle with a given radius. Assist students to practise construction of circles with a given radius.</p> <p>Illustrate how to construct a circle through three points not on the same straight line.</p>	<p>Students to identify the various properties and parts of a circle.</p> <p>Students to construct a circle with given properties.</p>

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 9 PROPERTIES AND CONSTRUCTION OF TANGENTS	<p>The student will be able to:</p> <p>1.9.1 explain tangent.</p> <p>1.9.2 explain the relationships among centres, normal and tangents.</p> <p>1.9.3 construct tangents to a circle at a given point.</p> <p>1.9.4 construct tangents to a circle from a given point outside the circle.</p> <p>1.9.5 construct external and internal tangents to two equal and unequal circles.</p>	<p>Tangent and its properties.</p> <p>Relationships among centre, normal and tangent.</p> <p>Construction of a tangent to a circle at a given point.</p> <p>Construction of tangents to a circle from a given point outside the circle.</p> <p>Construction of an external and internal tangents to two equal and unequal circles.</p>	<p>Discuss the properties of tangent with students.</p> <p>Group students to discuss the relationships among centres, normals and tangents in groups.</p> <p>Illustrate the construction of tangents to a circle at a given point on the circle and assist students to practise.</p> <p>Illustrate the principles of constructing tangents to a circle from a point outside the circle and assist students to practise.</p> <p>Illustrate the principles involved in constructing external tangents to:</p> <ol style="list-style-type: none"> 1. two equal circles 2. two unequal circles <p>Students to practise all the principles.</p> <p>Illustrate the principles involved in constructing internal tangents to:</p> <ol style="list-style-type: none"> 1. two equal circles 2. two unequal circles <p>Students to practise all the principles.</p>	<p>Students to list the properties of a tangent.</p> <p>Students to explain the relationships among centres, normal and tangent.</p> <p>Students to construct tangents at a point on a circle.</p> <p>Students to construct a tangent to a circle from a point outside the circle.</p> <p>Students to explain the principles for constructing external tangents to two equal and unequal circles.</p> <p>Students to explain the principles for constructing internal tangents to two equal and unequal circles.</p> <p>Students to construct an external and internal tangent to two equal circles and two unequal circles.</p>

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 9 (CONT'D) PROPERTIES AND CONSTRUCTION OF TANGENTS	The student will be able to:			
	1.9.6 explain the practical application of tangency.	Application and principles of tangency: e.g. spanners, anchors and other engineering components.	Discuss the practical application of tangency with students and assist students to practice other examples in groups.	Students to explain the practical applications of tangency.
	1.9.7 explain the principles of blending two arcs.	Principles of blending arcs. e.g. spanners and anchors.	Discuss the principles of blending arcs with students groups.	Students to explain the principles of blending arcs.
	1.9.8 construct plane figures involving blending of lines and arcs.	Plane figures involving blending of lines and arcs.	Illustrate the principles involved in constructing plane figures with blending of lines and arcs and assist students to practice. Guide students to calculate the radii of different arcs. Guide students to determine point of contact of the arcs.	Students to construct plane figures involving blending of lines and arcs such as spanners, anchors and openers. Students to indicate point of contact on their drawn figures.
UNIT 10 INSCRIBED, CIRCUMSCRIBED, ESCRIBED CIRCLES	1.10.1 differentiate among circumscribed, inscribed escribed circles.	Inscribed, escribed, circumscribed circles.	Using charts show examples of circumscribed, inscribed, escribed circles, for students to differentiate them.	Students to explain inscribed, circumscribed and escribed circles.
	1.10.2 construct circumscribed, inscribed, escribed circles.	Construction of inscribed, escribed, circumscribed circles.	Illustrate the construction of inscribed, escribed, circumscribed circles and assist students to practice.	Students to construct inscribed, circumscribed, escribed circles.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 11 ENLARGEMENT AND REDUCTION OF SIMILAR FIGURES	<p>The student will be able to:</p> <p>1.11.1 outline the principles involved in the construction of similar figures of equal size.</p> <p>1.11.2 enlarge and reduce plane figures based on size.</p> <p>1.11.3 enlarge figures based on the ratio of areas.</p> <p>1.11.4 reduce figures based on ratio of areas.</p>	<p>Principles in the construction of similar figures. Similar figures in equal parts and areas.</p> <p>Enlargement and reduction of plane figures. Enlargement of equal areas of figures.</p> <p>Principles of enlargement of figures based on areas.</p> <p>Reduction of figures based on ratio of areas.</p>	<p>Group students to discuss similar figures.</p> <p>Discuss the principles of enlargement and reduction of figures with students.</p> <p>Illustrate the construction of enlargement of figures based on ratio of size and assist students to practice.</p> <p>Illustrate how to reduce a drawn figure based on the ratio of size and assist students to practice.</p>	<p>Students to explain similar figures.</p> <p>Students to explain the principles of enlargement and reduction of figures.</p> <p>Students to enlarge a given figure.</p> <p>Students to reduce a drawn figure based on ratio of size.</p>
UNIT 12 CONVERSION OF EQUAL AREAS OF FIGURES	<p>1.12.1 outline the principles of determining figures of equal areas.</p> <p>1.12.2 state the principles of converting the shape of a plane figure to another of equal area.</p> <p>1.12.3 convert the shape of a plane figure to another of equal area by construction.</p>	<p>Figures of equal areas.</p> <p>Conversion of plane figures.</p> <p>Construction of plane figures of equal area.</p>	<p>Guide students to discuss the principles for determining figures of equal areas with students.</p> <p>Illustrate the construction of enlarging figures based on ratio of areas and assist students to practice.</p> <p>Guide students to reduce figures based on ratio of areas by construction.</p> <p>Group students to discuss the principles of converting the shape of a plane figure to another of equal area using charts.</p> <p>Illustrate by construction how to convert one plane figure to another of equal area.</p>	<p>Students to explain the principles for determining figures of equal area.</p> <p>Students to enlarge a given figure based on ratio of areas.</p> <p>Students to reduce a given figure based on ratio of areas.</p> <p>Students to discuss the principles of converting the shape of a plane figure to another of equal area in groups.</p> <p>Students to convert the shape of a given figure to another of equal area by construction.</p>

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 13 CONSTRUCTION OF CONIC SECTIONS	<p>The student will be able to:</p> <p>1.13.1 define ellipse, parabola and hyperbola.</p> <p>1.13.2 identify the importance of hyperbola, parabola and ellipse.</p> <p>1.13.3 explain the practical application of each shape or curve.</p> <p>1.13.4 construct ellipse, parabola and hyperbola.</p>	<p>Definition of ellipse, parabola and hyperbola.</p> <p>Importance of hyperbola, parabola and ellipse. For developing component parts of machine.</p> <p>Application of conic sections (ellipse, parabola and hyperbola).</p> <p>Construction of ellipse, parabola and hyperbola using different methods.</p>	<p>Group students to discuss ellipse, parabola, and hyperbola and discuss their properties.</p> <p>Group students to discuss the properties of ellipse, hyperbola and parabola using charts.</p> <p>Discuss the practical applications of conic sections.</p> <p>Illustrate the construction of conic sections (ellipse, parabola and hyperbola) Guide students to practise the construction of these conic sections.</p>	<p>Students to define ellipse, parabola and hyperbola.</p> <p>Students to discuss the properties of ellipse, parabola and hyperbola on the chart in groups.</p> <p>Students to state the applications of each conic section.</p> <p>Students to construct the three conic sections, (ellipse, parabola and hyperbola) using different methods.</p>

SENIOR HIGH SCHOOL – YEAR 2

SECTION 1

PLANE GEOMETRY

General objectives: The student will:

1. recognize different types of loci.
2. apply skills and techniques in constructing different loci.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 1 LOCI	The student will be able to: 1.1.1 Identify common types of loci. 1.1.2 explain locus. 1.1.3 explain different types of loci. 1.1.4 construct different types of loci	Common types of loci: helix, spiral, cycloid, epicycloid, involute, link mechanism, ellipse. Meaning of Locus: Locus as a curve of moving point on an object. Types of Loci: e.g. Loci as paths traced by moving points under given conditions.	Show charts, real objects and models, of loci to students. Group students to discuss the meaning of locus. Discuss the different types of loci. Discussion should include different conditions of moving points to trace different types of loci. Illustrate how to construct the loci. Guide students to practise the techniques for drawing different loci.	Students to state common types of loci. Students to explain locus of a point. Students to explain conditions of different types of loci. Students to construct the various loci.

SENIOR HIGH SCHOOL – YEAR 2

SECTION 2

SOLID GEOMETRY

General objectives: The student will:

1. acquire knowledge and skills for drawing three dimensional objects.
2. acquire knowledge and skills for drawing objects in isometric projections.
3. develop skills and techniques for sketching in oblique projections
4. develop skills and techniques for sketching in perspectives .

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 1 PICTORIAL DRAWINGS	The student will be able to: 2.1.1 identify types of pictorial drawing. 2.1.2 explain isometric drawing and its principles. 2.1.3 describe and explain oblique drawing and its principles. 2.1.4 describe perspective drawings. 2.1.5 use isometric axis to draw given objects. 2.1.6 use oblique axis to draw given objects. 2.1.7 draw objects in one point and two-point perspectives.	Types of pictorial drawings (isometric, oblique and perspectives) Principles of isometric drawing. Has 30° receding lines and all the vertical lines are parallel Principles of oblique drawing. One side horizontal and other side 45 to the horizontal and is drawn half full size. Perspective drawings (one point and two-point) Using Isometric axis to draw given objects. Oblique drawing. Drawing objects in one point and two-point perspectives.	Using charts, discuss types of pictorial drawing. Using models/charts, discuss the principles of isometric drawing with students. Using illustrations, discuss the principles of oblique drawing with students. Using charts, discuss one point and two-point perspectives with students. Illustrate how to apply the principles to draw objects in isometric and assist students to practise. Illustrate how to apply the principles to draw objects in oblique and assist students to practice. Illustrate how to draw objects in one point and two- point perspectives.	Students to explain the principles for isometric drawing. Students to convert orthographic projections to isometric drawings Students to draw objects in oblique projection. Students to draw objects in one point and two-point perspectives. Students to explain the principles of oblique projection. Students to convert orthographic projection to oblique projection. Students to convert isometric or oblique to perspective drawings.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 2 DIMENSIONING	The student will be able to: 2.2.1 explain the principles of dimensioning. 2.2.2 explain the importance of dimensioning . 2.2.3 apply the principles of dimensioning.	Principles of dimensioning. Scaling and accuracy. The use of dimension line. Importance of dimensioning. Application of principles of dimensioning.	Group students to discuss the principles of dimensioning. Using charts, assist students to discuss the importance of dimensioning. Using charts, illustrate the application of principles of dimensioning to students. Guide students to practise how to dimension drawn objects. Note: Emphasize how to dimension circles, radius, curves, holes and circular parts, rods, angles and small measurements. NOTE: Refer to B.S.308 and B.S. 1192.	Students to explain the principles of dimensioning. Students to explain the importance of dimensioning. Students to dimension given drawings correctly using B.S 308 and B.S 1192.
UNIT 3 ORTHOGRAPHIC PROJECTIONS	2.3.1 explain orthographic projection 2.3.2 explain the principles of both first and third angle projections. 2.3.3 distinguish between first and third angle projections. 2.3.4 draw objects in first and third angle projections.	Orthographic projections Principles of first and third angle projections. First and third angle projections. The vertical and horizontal planes. First angle projection, the object is between the viewer and the plane Third angle projections, the plane is between the viewer and the object. Drawing in first and third angle projections. Symbols for first and third angle projections. Correct positioning of views.	Discuss orthographic projections with students Using charts and models discuss the principles of first and third angle projections. Illustrate the vertical and horizontal planes. Discuss the differences and similarities between first and third angle projections. Illustrate how to draw in first and third angle projections and assist students to practise. Guide students to show the appropriate symbols for each projection. Guide students to practise orthographic drawings using selected objects. NOTE: Emphasize neat work, correct projection, symbols and construction lines.	Students to explain orthographic projections. Students to explain the principles of first and third angle projections. Students to explain the differences between first and third angle projections Groups students to draw objects in first and third angle projections stating at least, six major dimensions correctly and indicating the correct symbols for each projection and submit report

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 4 SECTIONAL VIEWS AND TRUE SHAPES OF CUT SURFACES	<p>The student will be able to:</p> <p>2.4.1 explain the concept of sectioning</p> <p>2.4.2 state the importance of sectioning.</p> <p>2.4.3 explain the true shape of cut surfaces of various geometrical objects.</p> <p>2.4.4 explain and apply the principles of drawing the true shape of a cut surface.</p> <p>2.4.5 construct true shapes of cut surfaces.</p> <p>2.4.6 explain and apply the rules for hatching the true shape of a cut surface.</p> <p>2.4.7 apply principles of sectioning to draw conic sections.</p>	<p>Sectional views and true shapes of cut surfaces of various geometrical objects: prisms, cylinders, pyramids and cones.</p> <p>Importance of sectioning.</p> <p>True shapes of cut surfaces.</p> <p>Application of drawing true shapes of cut surfaces.</p> <p>Construction of true shapes.</p> <p>Rules for hatching.</p> <p>Applying principles to draw conic sections.</p>	<p>Use models and charts to brainstorm the concept and importance of sections.</p> <p>Guide students to discuss the importance of drawing true shapes of cut surfaces of objects (e.g. truncated and frustums).</p> <p>Use charts and models to discuss the true shapes of cut surfaces of solids. Display objects of various shapes of cut surfaces with corresponding charts of their true shapes for students to match.</p> <p>Illustrate how to apply the principles of constructing true shapes of cut surfaces.</p> <p>Guide students to apply the principles of sections to construct true shapes of cut surfaces. Students to brainstorm the rules for hatching true shapes of cut surfaces of objects.</p> <p>Use charts to discuss the rules for hatching a true shape of a cut surface and assist students to practise (e.g. angle of inclination of lines and spacing).</p> <p>Guide students to apply the principles and rules for drawing sectional views of cones.</p>	<p>Students to state the concept of sectioning.</p> <p>Students to state reasons for sectioning.</p> <p>Students to explain the principles of constructing true shapes of cut surfaces.</p> <p>Students to construct the true shape of cut surfaces of solids.</p> <p>Students to draw the true shapes of sections of cones.</p>

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 5 SURFACE DEVELOPMENT	<p>The student will be able to:</p> <p>2.5.1 explain the principles of surface development.</p> <p>2.5.2 outline the importance of surface development of objects.</p> <p>2.5.3 construct surface development of right and oblique solids.</p> <p>2.5.4 construct the surface development of frustum of solids.</p>	<p>Principles of surface development.</p> <p>Importance of surface development.</p> <p>Surface development of right and oblique solids (e.g. pyramids, prisms, cylinders and cones).</p> <p>Construction of surface development of frustum of solids (e.g. pyramids, prisms, cones and cylinders).</p>	<p>Using charts, discuss the principles of surface development with students.</p> <p>Group students to discuss the importance of surface development.</p> <p>Use illustrations and models to show how to develop right and oblique solids and guide students to practise.</p> <p>Use models and illustrations to show how to develop frustum of the various solids.</p> <p>Guide students to develop the frustum of the various solids. NOT: Emphasize on "True Length"</p>	<p>Students to explain the principles of surface development.</p> <p>Students to explain the importance of surface development.</p> <p>Students to identify the right solids and oblique solids. Students to construct surface developments of right and oblique solids.</p> <p>Students to develop surfaces of frustums.</p>
UNIT 6 AUXILIARY PROJECTIONS	<p>2.6.1 explain principles of auxiliary Projection.</p> <p>2.6.2 distinguish between auxiliary planes and principal planes.</p> <p>2.6.3 project first and second auxiliary Views.</p>	<p>Principles of auxiliary elevations and planes.</p> <p>Differences between auxiliary and principal planes.</p> <p>First and Second auxiliary projections.</p>	<p>Discuss the principles of auxiliary projections.</p> <p>Discuss the difference between auxiliary planes and principal planes with students. Students to distinguish between auxiliary and principal planes.</p> <p>Assist students to project first auxiliary plane and elevation from given views.</p> <p>Assist students to project second auxiliary plane and elevation from given views.</p>	<p>Students to explain the principles of auxiliary projections.</p> <p>Students to distinguish between auxiliary and principal planes.</p> <p>Students to draw auxiliary projections from given views in:</p> <ol style="list-style-type: none"> 1. first auxiliary plan and elevation 2. second auxiliary plan and elevation

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 7 INTRODUCTION TO AUTO CAD	<p>The student will be able to:</p> <p>2.7.1 explain the term Auto CAD.</p> <p>2.7.2 explain the concept of Auto CAD.</p> <p>2.7.3 state the importance of Auto CAD</p> <p>2.7.4 explain the characteristics of various setting modes in Auto CAD and apply them.</p> <p>2.7.5 outline the principles of Auto CAD.</p> <p>2.7.6 examine the various symbols used in Auto CAD.</p> <p>2.7.7 select basic template for drawing simple objects.</p> <p>5.7.8 demonstrate the application of modes in Auto CAD.</p>	<p>Auto CAD means Computer Aided Design.</p> <p>Concept of Auto CAD.</p> <p>Importance of Auto CAD in Technical Drawing</p> <p>Setting modes in Auto CAD (e.g. SNAP, GRID, ORTHO, OSNAP, LWT and OTRACK, and POLAR).</p> <p>Principles of Auto CAD.</p> <p>The various symbols tools used in Auto CAD (e.g. title bar, standard bar, menu tool bar, drawing tool bar and modifying tool bar).</p> <p>Selection of basic template for drawing simple objects.</p>	<p>Group students to discuss the meaning of Auto CAD.</p> <p>Students to brainstorm the concept of Auto CAD in groups.</p> <p>Discuss the importance of Auto CAD in Technical drawing.</p> <p>Assist students to design and construct simple objects using auto CAD.</p> <p>Discuss the characteristics of various setting modes.</p> <p>Group students to discuss the principles of Auto CAD.</p> <p>Using sketches, show students the various symbols of tools used in Auto CAD.</p> <p>Discuss the various templates and how they are used for drawing simple objects.</p> <p>Select simple geometrical objects and assist students to list the tools for drawing them.</p> <p>Demonstrate the application of the modes in Auto CAD.</p>	<p>Students to explain the characteristics of the various setting modes.</p> <p>Students to explain the principles of Auto CAD.</p> <p>Students to identify various tools for drawing geometrical and solid figures.</p> <p>Students to construct simple drawings of objects.</p> <p>Students to demonstrate the use of setting modes in Auto CAD.</p>

SENIOR HIGH SCHOOL – YEAR 2

SECTION 3 (A)

BUILDING DRAWING OPTION

General objectives: The student will:

1. acquire skills and techniques in freehand sketching.
2. recognize specifications for building drawings
3. understand the principles of intersections.
4. be aware of appropriate techniques in architectural drawings.
5. recognize electrical and plumbing symbols.
6. Understand the construction of arches.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 1 FREEHAND SKETCHING OF BUILDING TOOLS AND EQUIPMENT	The student will be able to: 3.1.1 outline the principles and techniques of freehand sketching.	Principles and techniques of freehand sketching. It must be done considering proportionality and pictorial in nature.	Group students to discuss the principles and techniques of freehand sketching.	Students to explain the principles and techniques of freehand sketching.
	3.1.2 sketch various building tools and components.	Sketches of building tools and components 1. pictorial drawing 2. orthographic projection	Illustrate how to sketch building tools and components in pictorial drawing and assist students to practice. Illustrate how to sketch various building tools and components in orthographic projection. Guide students to sketch building tools and components in pictorial and orthographic projections.	Students to sketch building tools and components in pictorial drawing. Students to sketch selected building tools and components in orthographic projections. Student to sketch building details.
UNIT 2 BRITISH STANDARD (B.S. 1192); BUILDING DRAWING	3.2.1 explain the purpose of British Standard 1192.	Purpose of British Standard (B.S 1192) building drawing.	Group students to discuss the purpose of British Standard (B.S 1192).	Students to explain the purpose of B.S.1192.
	3.2.2 use the British Standard (B.S 1192) in preparing drawings.	Application of British Standard (B.S. 1192).	Discuss how to apply B.S 1192 in preparation and interpretation of drawings with students. Illustrate how to use the British Standard (B.S. 1192) to prepare drawings (e.g. ground floor buildings etc).	Students to apply the B.S 1192 in preparing drawings.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 3 ELECTRICAL AND PLUMBING SYMBOLS	<p>The students will be able to:</p> <p>3.3.1 identify basic electrical and plumbing symbols.</p> <p>3.3.2 prepare drawings of basic electrical and plumbing symbols.</p>	<p>Electrical symbols (e.g. socket, fan, bell, switch).</p> <p>Plumbing symbols (e.g. bath, W.C., sink, showers).</p> <p>Drawing of electrical and plumbing symbols.</p>	<p>Show charts to students to brainstorm on electrical and plumbing symbols. Discuss the basic electrical and plumbing symbols using sketches or charts.</p> <p>Using charts, show students the basic plumbing and electrical symbols.</p> <p>Guide students to use the symbols to prepare simple drawings.</p>	<p>Students to identify electrical and plumbing symbols from charts.</p> <p>Students to sketch the symbols for various electrical and plumbing fittings.</p> <p>Students to prepare drawings and show selected electrical and plumbing symbols.</p>
UNIT 4 INTERSECTIONS OF STRAIGHT AND CURVED MOULDINGS	<p>3.4.1 identify types of mouldings.</p> <p>3.4.2 determine intersections of straight and curved mouldings.</p> <p>3.4.3 draw mouldings in the same plane.</p> <p>3.4.4 determine the true shape of mitres.</p>	<p>Types of mouldings (straight and curved).</p> <p>Intersections of straight and curved mouldings.</p> <p>Mouldings in the same plane.</p> <p>True shape of mitres.</p>	<p>Using charts and models, show types of mouldings in the same plane.</p> <p>Group students to brainstorm the principles of intersections of straight and curved mouldings.</p> <p>Illustrate various methods of determining types of intersecting mouldings and assist students to practice.</p> <p>Use models to illustrate types of mouldings in the same plane. Guide students to draw types of mouldings in the same plane.</p> <p>Use charts to illustrate how to determine true shape of mitres.</p> <p>Guide students to determine true shape of mitres.</p>	<p>Students to identify types of mouldings.</p> <p>Students to explain the principles of intersections of mouldings in the same plane.</p> <p>Students to draw mouldings in the same plane.</p> <p>Students to determine true shape of mitres.</p>

SENIOR HIGH SCHOOL – YEAR 2

SECTION 3 (B)

MECHANICAL ENGINEERING OPTION

General objectives: The student will:

1. acquire skills in freehand sketching.
2. apply skills and techniques for drawing types of fasteners and locking devices.
3. apply appropriate techniques in working drawings.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 1 FREEHAND SKETCHING OF ENGINEERING TOOLS AND EQUIPMENT :	The students will be able to: 3.1.1 explain the principles and techniques of freehand sketching. 3.1.2 sketch engineering components and tools in pictorial and orthographic projections.	Principles and techniques of freehand sketching. Sketches of engineering components and tools. 1. pictorial drawing 2. orthographic projection	Assist students to brainstorm the principles and techniques of freehand sketching. Use charts and engineering models to illustrate how to sketch various objects in pictorial and orthographic projections. Guide students to sketch engineering components.	Students to explain the principles and techniques of freehand sketching. Students to sketch engineering components and tools.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
<p>UNIT 2</p> <p>BRITISH STANDARD (B.S. 308): ENGINEERING DRAWING</p> <p>UNIT 3</p> <p>FASTENERS AND LOCKING DEVICES</p>	<p>The student will be able to:</p> <p>3.2.1 explain the purpose of British Standard (B.S. 308).</p> <p>3.2.2 apply the Standard (B.S 308) for drawings.</p> <p>3.3.1 identify fasteners and locking devices</p> <p>3.3.2 explain the importance of fasteners and locking devices.</p> <p>3.3.3 differentiate between fasteners and locking devices.</p> <p>3.3.4 sketch fasteners and locking devices.</p>	<p>British Standard (B.S.308) engineering drawing.</p> <p>Application of British Standard (B.S. 308) for drawings.</p> <p>Types of fasteners and locking devices.</p> <p>Importance of fasteners and locking devices. They are used to put pieces of work together, either permanent or temporal</p> <p>Differences between locking device and fasteners.</p> <p>Sketching of fasteners and locking devices (e.g. bolts, nuts, screws, studs, splined shafts, cotters and collars).</p>	<p>Discuss the purpose of British Standard (B.S.308) with students in groups</p> <p>Demonstrate how to apply B.S, 308 in preparation and interpretation of drawings with students. Students to use the B.S 308 in preparing drawings.</p> <p>Display fasteners and locking devices for students to identify.</p> <p>Group students to discuss the purpose of using fasteners and locking devices in engineering.</p> <p>Group students to discuss areas of where fasteners and locking devices are used in engineering assembly.</p> <p>Group students to discuss the differences between fasteners and locking devices using real objects, charts and models. Display real objects or items for students to differentiate.</p> <p>Use models, real objects, and illustrations to show how to draw fasteners and locking device. Guide students to draw fasteners and locking devices.</p>	<p>Students to explain the purpose of B.S 308.</p> <p>Students to apply BS 308 in drawing.</p> <p>Students to state reasons for using fasteners and locking devices in engineering.</p> <p>Students to brainstorm on applications of fasteners and locking devices in engineering assembly.</p> <p>Students to explain the differences between fasteners and locking devices.</p> <p>Students to draw selected fasteners and locking devices in pictorial views by freehand.</p>

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 3 (CONT'D) FASTENERS AND LOCKING DEVICES	<p>The student will be able to:</p> <p>3.3.5 identify conventional representations of various fasteners and locking devices(screws, bolt and nut, studs, spring)</p> <p>3.3.6 sketch conventional representations of fasteners and locking devices.</p>	<p>Conventional representations of various fasteners and locking devices.</p> <p>Sketches of conventional representations of fasteners and locking devices.</p>	<p>Using charts, show conventional representations of fasteners and locking devices to students.</p> <p>Use charts to illustrate how to sketch various components conventionally. Guide students to sketch various fasteners and locking devices conventionally.</p>	<p>Students to match the pictorial drawings with conventional representation of fasteners and locking devices.</p> <p>Students to prepare drawings of engineering components showing conventional representations of fasteners and locking devices.</p>
UNIT 4 CONVENTIONAL REPRESENTATIONS OF WELDED AND RIVETED JOINTS	<p>3.4.1 identify different welded and riveted joints and explain their purposes.</p> <p>3.4.2 identify the conventional representations of welded and riveted joints.</p> <p>3.4.3 differentiate between welded and riveted Joints.</p> <p>3.4.4 draw various types of joints.</p>	<p>Welded and riveted joints.</p> <p>Conventional representations of welded and riveted joints.</p> <p>Differences in welded and riveted joints.</p> <p>Drawing types of joints: welded and riveted (lap, butt and double butt).</p>	<p>Using illustrations and models show types of joints to students.</p> <p>Using charts, show conventional representations of various joints to students.</p> <p>Group students to discuss types of welded joints (e.g. lap, butt and double butt) and the purpose of using them.</p> <p>Discuss the differences between riveted and welded joints.</p> <p>Group students to discuss the merits and demerits of riveted and welded joints.</p> <p>Illustrate how to draw types of joints using charts, models and real objects.</p>	<p>Students to state the uses of joints.</p> <p>Students to identify the differences between the pictorial drawing and conventional representations of the various joints.</p> <p>Students to discuss types of joints and state their differences.</p> <p>Students to sketch types of welded and riveted joints in freehand.</p>

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 4 (CONT'D) CONVENTIONAL REPRESENTATIONS OF WELDED AND RIVETED JOINTS	The student will be able to: 3.4.5 sketch conventional representations of types of welded and riveted joints.	Sketching of conventional representations of joints.	Use charts to illustrate how to sketch various joints conventionally. Guide students to sketch various joints conventionally.	Students to sketch the conventional representations of the various welded and riveted joints.

SENIOR HIGH SCHOOL – YEAR 3

SECTION 4 (A)

BUILDING DRAWING OPTION

General Objectives: The student will:

1. acquire skills and techniques in architectural drawing.
2. develop the ability to interpret simple building plans and their detailed drawings.
3. be aware of the principles of solving simple building drawing problems.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 1 CONSTRUCTIONAL DETAILS OF BUILDINGS	The student will be able to: 4.1.1 identify main parts of buildings. 4.1.2 draw details of parts of buildings.	Main parts of buildings: sub-structure, super-structure and roof. Detailed parts of buildings: Foundations, jambs, walls and openings, sills, lintel, roofs, doors and windows, simple staircase (straight flight, quarter turn, half turn, dogleg etc), frames, linings, floors, architraves, simple reinforcement for beams, columns, piers and slabs.	Use models and sketches to brainstorm to come out with the main parts of a building. Using models, discuss the main parts of buildings with students. Guide students to draw detailed parts of buildings.	Students to differentiate between sub structure and supper structure of buildings. Students to draw detailed parts of buildings.
UNIT 2 ROOFS	4.2.1 identify different types of roofs. 4.2.2 draw various types of roofs.	Types of roofs: flat and pitched (kinds of pitched e.g. hip, gable, combined hip and shed roof). Drawings of types of roofs (flat and pitched).	Use charts and models to illustrate types of roofs and stating their differences. Illustrate the drawings of various roofs using charts and models. Guide students to draw various roofs.	Students to explain the differences between types of roofs. Students to draw the various types of roofs

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 2 (CONT'D) ROOFS	<p>The student will be able to:</p> <p>4.2.3 develop roof surfaces and determine bevels.</p> <p>4.2.4 draw sectional views of various pitched and flat roofs.</p>	<p>Roof development and determination of bevels. (angle of inclination).</p> <p>Sectional views of pitched and flat roofs.</p>	<p>Assist students to discuss the principles and methods of developing surfaces of roof.</p> <p>Guide students to demonstrate the techniques of determining the roof bevel.</p> <p>Guide students to develop types of roof surfaces and indicate bevels.</p> <p>Illustrate how to draw sectional views of various pitched and flat roofs for students to practise.</p>	<p>Students to develop given surfaces of roofs.</p> <p>Students to determine the bevel position of a roof.</p> <p>Students to draw the sectional views of selected flat and pitched roofs.</p>
UNIT 3 ORTHOGRAPHIC PROJECTIONS OF BUILDINGS	<p>4.3.1 apply the principles of orthographic projections to buildings.</p> <p>4.3.2 draw sectional elevations of buildings.</p>	<p>Orthographic projections of building (plans and elevations).</p> <p>Sectional elevations of buildings up to two floors.</p>	<p>With models and charts, illustrate the orthographic projections of buildings with students.</p> <p>Guide students to use different scales in drawing sectional elevations of buildings.</p> <p>Assist students to visit building industries and construction sites to see at first hand the relationship between the buildings and the drawings.</p> <p>Guide students to write report after visit.</p>	<p>Students to apply the principles of orthographic projection to buildings.</p> <p>Students to use different scales for drawing sectional elevations.</p> <p>Students to write group report after industrial visit and discuss in class.</p>

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 4 WORKING DRAWINGS	<p>The student will be able to:</p> <p>4.4.1 prepare building plans.</p> <p>4.4.2 demonstrate requisite skills in draughtmanship.</p> <p>4.4.3 indicate dimensions on building plans.</p> <p>4.4.4 label building plans.</p>	<p>Preparation of building plans of small dwellings, garages, and sheds up to two floors.</p> <p>Acquisition of skills in draughtmanship e.g. accuracy, neatness and quality of work.</p> <p>Dimensioning of building plans.</p> <p>Labelling of views and details of building plans..</p>	<p>Discuss with illustrations the principles of orthographic projections emphasizing the sectional plan.</p> <p>Guide students to draw simple building plans.</p> <p>Assist students to discuss the skills required in draughtmanship.</p> <p>Students to carry out draughtmanship practices and demonstrating accuracy and neatness in exercises.</p> <p>Illustrate how to dimension views or details of building plans with students using charts.</p> <p>Illustrate how to label and letter views and details of building plans.</p> <p>Guide students to label and letter views and details of building plans.</p>	<p>Students to prepare building plans from given information.</p> <p>Students to carry out draughtmanship practices and demonstrate accuracy and neatness in their exercises.</p> <p>Students to dimension details of building plans correctly.</p> <p>Students to label views and details of building plans correctly.</p>

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 5 FORCES AND FRAMED STRUCTURES	<p>The student will be able to:</p> <p>4.5.1 explain forces as vector quantities.</p> <p>4.5.2 determine the resultant and equilibrant of forces.</p> <p>4.5.3 determine the reaction for a framed structure.</p> <p>4.5.4 determine the magnitude and nature of forces in the members of framed structures.</p>	<p>Forces (co-planar, concurrent and parallel).</p> <p>Resolution of forces (triangle, parallelogram and polygon of forces).</p> <p>Simple framed structure (determination by Bow's Notation).</p> <p>Magnitude and nature of Forces in members of framed structure.</p>	<p>Group students to brainstorm to come out with the fact that forces have magnitude and direction.</p> <p>Guide students to draw a system of given forces.</p> <p>Discuss the differences between parallel and concurrent forces.</p> <p>Demonstrate the construction of triangle and polygon of forces.</p> <p>Guide students to draw the magnitude and direction of forces to scale.</p> <p>Note: Stress that static forces are always in equilibrium.</p> <p>Demonstrate the construction of triangle and polygon of forces.</p> <p>Illustrate graphically the use of Bow's Notation and polygon of forces to determine the reaction of structures.</p> <p>Guide students to use the concept of triangle and polygon of forces to determine forces in framed structures and on beams.</p> <p>Group students to discuss the nature of forces in framed structures or on beams.</p> <p>Use illustrations to explain the principles of Bow's Notation with students.</p> <p>Organise visits for students to industries to observe members of framed structures and write group report.</p>	<p>Students to draw given forces.</p> <p>Students to differentiate between the resultant and equilibrium of forces.</p> <p>Students to determine the reactions of a loaded framed structure.</p> <p>Students to explain the principles of Bow's Notation.</p> <p>Students to determine the magnitude and nature of forces in the members of framed structure graphically.</p> <p>Students to write group reports after the visits and discuss in class.</p>

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
<p>UNIT 6</p> <p>SHEARING FORCES AND BENDING MOMENT DIAGRAMS</p>	<p>The student will be able to:</p> <p>4.6.1 explain the effects of shearing forces and bending moments on a beam.</p> <p>4.6.2 describe the variation of shearing forces and bending moments along the length of a beam.</p> <p>4.6.3 construct shearing force and bending moment diagrams graphically.</p>	<p>Effects of shearing forces and bending moments.</p> <p>Variations of shearing forces and bending moments along the length of a beam.</p> <p>Shearing force and bending moment diagrams for:</p> <ol style="list-style-type: none"> 1. concentrated and uniformly distributed loads. 2. simply supported beams and cantilevers. 	<p>Using charts, group students to discuss effects of shearing forces and bending moments.</p> <p>Using charts, illustrate the shearing force and bending moment diagrams for concentrated and evenly distributed loads.</p> <p>Guide students to solve simple problems on shearing force and bending moments graphically.</p> <p>Demonstrate graphically the construction of shearing force and bending moment diagrams for simply supported beam and cantilever with concentrated and uniformly distributed loads.</p>	<p>Students to explain the effects of shearing forces and bending moments in a beam.</p> <p>Students to sketch and describe variations of shearing forces and bending moments along the length of a beam.</p> <p>Students to solve problems graphically on</p> <ol style="list-style-type: none"> 1. shearing forces and bending moments 2. simply supported beam and cantilevers.
<p>UNIT 7</p> <p>CENTRE OF GRAVITY OF FORCES ACTING ON A BODY</p>	<p>4.7.1 explain the term centre of gravity'.</p> <p>4.7.2 determine the centre of gravity of forces.</p>	<p>Centre of gravity of forces.</p> <p>Centre of gravity of forces acting on a section (e.g. lamina of geometrical shapes).</p>	<p>With the aid of sketches and charts, assist students to discuss centre of gravity.</p> <p>Illustrate how to determine the centre of gravity of simple geometrical shapes. Guide students to determine positions of centroid of different sections graphically.</p> <p>Illustrate the construction for the determination of centre of gravity by:</p> <ol style="list-style-type: none"> 1. finding the resultant of all vertical forces 2. finding the resultant of all horizontal forces 	<p>Students to explain centre of gravity of a body.</p> <p>Students to determine the centre of gravity of simple geometrical shapes.</p> <p>Students to determine graphically the positions of centroid of different sections.</p>

SENIOR HIGH SCHOOL – YEAR 3

SECTION 4 (B)

MECHANICAL ENGINEERING DRAWING OPTION

General Objectives: The student will:

1. understand dimensions, tolerances, limits and fits.
2. acquire skills for freehand sketching.
3. acquire skills for the preparation of working drawings.
4. be aware of the principles in solving drawing problems.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 1 DIMENSIONING AND TOLERANCES	The student will be able to:			
	4.1.1 explain the terms tolerance, limits and fits'.	Tolerance limits and fits.	Using models and charts, group students to discuss tolerance, limits and fits	Students to explain tolerance, limits and fits.
	4.1.2 explain how to dimension drawings.	Dimensioning drawings: Methods of indicating tolerances, limits and fits.	Illustrate how to dimension drawn objects. Guide students to dimension objects correctly by using Data Charts. (4500A Shaft/Hole Bases)	Students to dimension drawn components using Data Chart correctly.
	4.1.3 explain the different types of fits.	Types of fits (clearance fit, transition fit, and interference fit) and their applications.	Discuss and illustrate the different types of fit and their applications using charts.	Students to sketch various applications of limits and fits.
UNIT 2 SECTIONING	4.1.4 apply techniques of dimensioning drawn objects.	Dimensioning drawn objects.	Assist students to dimension drawn objects.	
	4.2.1 explain and differentiate between types of sectioning	Differences of sectioning. Types of sectioning: Full, half, part, offset, broken, removed, aligned and revolved.	Group students to discuss the differences between the types of sectioning using charts and illustrations.	Students to draw the various types of sections.
	4.2.2 draw sectional views of engineering components.	Sectional views of engineering components.	Illustrate how to draw sectional views of objects and components using the principles of the various types of sectioning (full, half, broken).	Students to draw sectional views of engineering components.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 5 FORCES AND FRAMED STRUCTURES	<p>The student will be able to:</p> <p>4.5.1 explain forces as vector quantities.</p> <p>4.5.2 determine the resultant and equilibrant of forces.</p> <p>4.5.3 determine the reaction for a framed structure.</p> <p>4.5.4 determine the magnitude and nature of forces in the members of framed structures.</p>	<p>Forces (co-planar, concurrent and parallel).</p> <p>Resolution of forces (triangle, parallelogram and polygon of forces).</p> <p>Simple framed structure (determination by Bow's Notation).</p> <p>Magnitude and nature of Forces in members of framed structure.</p>	<p>Group students to brainstorm and come out with the fact that forces have magnitude and direction.</p> <p>Guide students to draw a system of given forces.</p> <p>Discuss the differences between parallel and concurrent forces.</p> <p>Demonstrate the construction of triangle and polygon of forces.</p> <p>Guide students to draw the magnitude and direction of forces to scale.</p> <p>Note: Stress that static forces are always in equilibrium.</p> <p>Demonstrate the construction of triangle and polygon of forces.</p> <p>Illustrate graphically the use of Bow's Notation and polygon of forces to determine the reaction of structures.</p> <p>Guide students to use the concept of triangle and polygon of forces to determine forces in framed structures and on beams.</p> <p>Group students to discuss the nature of forces in framed structures or on beams. Use illustrations to explain the principles of Bow's Notation with students.</p> <p>Organise visits for students to industries to observe members of framed structures and write group report.</p>	<p>Students to draw given forces.</p> <p>Students to differentiate between the resultant and equilibrium of forces.</p> <p>Students to determine the reactions of a loaded framed structure.</p> <p>Students to explain the principles of Bow's Notation.</p> <p>Students to determine the magnitude and nature of forces in the members of framed structure graphically.</p> <p>Students to write group report after visits and discuss in class.</p>

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
<p>UNIT 6</p> <p>SHEARING FORCES AND BENDING MOMENT DIAGRAMS</p>	<p>The student will be able to:</p> <p>4.6.1 explain shearing and forces and bending moments their effects on a beam.</p> <p>4.6.2 describe the variation of shearing forces and bending moments along the length of a beam.</p> <p>4.6.3 construct shearing force and bending moment diagrams graphically.</p>	<p>Shearing forces and bending moments. Effects of shearing forces and bending moments.</p> <p>Variations of shearing forces and bending moments along the length of a beam.</p> <p>Shearing force and bending moment diagrams for:</p> <ol style="list-style-type: none"> 3. concentrated and uniformly distributed loads. 4. simply supported beams and cantilevers. 	<p>Assist students to discuss shearing forces and bending moments. Using charts, group students to discuss effects of shearing forces and bending moments.</p> <p>Using charts, show the shearing force and bending moment diagrams for concentrated and evenly distributed loads.</p> <p>Guide students to solve simple problems on shearing force and bending moments graphically.</p> <p>Demonstrate graphically the construction of shearing force and bending moment diagrams for simply supported beam and cantilever with concentrated and uniformly distributed loads.</p>	<p>Students to explain the effects of shearing forces and bending moments in a beam.</p> <p>Students to sketch and describe variations of shearing forces and bending moments along the length of a beam.</p> <p>Students to solve problems graphically on</p> <ol style="list-style-type: none"> 1. shearing forces and bending moments 2. simply supported beam and cantilevers.
<p>UNIT 7</p> <p>CENTRE OF GRAVITY OF FORCES ACTING ON A BODY</p>	<p>4.7.1 explain the term 'centre of gravity'.</p> <p>4.7.2 determine the centre of gravity of forces.</p>	<p>Centre of gravity of forces.</p> <p>Centre of gravity of forces acting on a section (e.g. lamina of geometrical shapes).</p>	<p>With the aid of sketches and charts, group students to discuss centre of gravity.</p> <p>Illustrate how to determine the centre of gravity of simple geometrical shapes. Guide students to determine positions of centroid of different sections graphically.</p> <p>Illustrate the construction for the determination of centre of gravity by:</p> <ol style="list-style-type: none"> 3. finding the resultant of all vertical forces 4. finding the resultant of all horizontal forces 	<p>Students to explain centre of gravity of a body.</p> <p>Students to determine the centre of gravity of simple geometrical shapes.</p> <p>Students to determine graphically the positions of centroid of different sections.</p>

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