CARIBBEAN EXAMINATIONS COUNCIL

Caribbean Advanced Proficiency Examination®

SYLLABUS

BUILDING AND MECHANICAL ENGINEERING DRAWING

CXC A22/U2/*26*

Effective for examinations from May–June 2027

CAPE®

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NOTE TO TEACHERS AND LEARNERS

This document CXC A22/U2/*26* replaces CXC A22/U2/15 issued in 2015.

Please note that the syllabus has been revised and amendments are indicated by italics.

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For access to short courses, training opportunities and teacher orientation webinars and workshops go to our Learning Institute at https://pli.cxc.org/

PLEASE NOTE

This icon is used throughout the syllabus to represent key features which teachers and learners may find useful.

Introduction

The Caribbean Advanced Proficiency Examination® (**CAPE®**) is designed to provide certification of the academic, vocational and technical achievement of students in the Caribbean who, having completed a minimum of five years of secondary education, wish to further their studies. The examinations address the skills and knowledge acquired by students under a flexible and articulated system where subjects are organised in 1-Unit or 2-Unit courses with each Unit containing three Modules. Subjects examined under **CAPE®** may be studied concurrently or singly.

The Caribbean Examinations Council offers three types of certification at the **CAPE®** level. The first is the award of a certificate showing each **CAPE®** Unit completed. The second is the **CAPE®** Diploma, awarded to candidates who have satisfactorily completed at least six Units, including Caribbean Studies. The third is the **CXC®** Associate Degree, awarded for the satisfactory completion of a prescribed cluster of *10* **CAPE®** Units including Caribbean Studies, Communication Studies and Integrated Mathematics. Integrated Mathematics is not a requirement for the **CXC®** Associate Degree in Mathematics *or for pursuing Pure and Applied Mathematics Unit 1 or 2.* The complete list of Associate Degrees may be found in the **CXC®** Associate Degree Handbook.

For the **CAPE®** Diploma and the **CXC®** Associate Degree, candidates must complete the cluster of required Units within a maximum period of five years. To be eligible for a **CXC®** Associate Degree, the educational institution presenting the candidates for the award, must select the Associate Degree of choice at the time of registration at the sitting (year) the candidates are expected to qualify for the award. Candidates will not be awarded an Associate Degree for which they were not registered.

Building and Mechanical Engineering Drawing Syllabus

♦ RATIONALE

Building and Mechanical Engineering Drawing (BMED*)* is the universal *graphic language of communication for individuals in the field of engineering and architecture as well as for technicians and craftsmen.* This type of universal communication is facilitated by the use of standards published by the International Organization for Standardization (ISO) for Engineering Drawing*. Building and Mechanical Engineering Drawing provides a significant contribution to the development of the human resources required for the creation of advanced designing and creative solutions to the twenty-first century demands of industrial production and manufacturing in the Caribbean. The syllabus also includes sustainable energy and sustainable design concepts which are of importance to the region, given the region's high vulnerability to the effects of climate change, increasing energy demands and dependency on imported fossil fuel to meet its energy needs.*

The course of study *for BMED incorporates aspects of architectural drawings as well as mechanical drawings for the development and communication of design ideas and concepts. As a form of graphical communication, the course provides the student with the opportunity of visualising and comprehending information presented verbally, graphically and mathematically*.

A student who completes this syllabus would be experienced in the use of the latest developments of Computer-Aided Design (CAD). In addition, the student would become dexterous in the application of the British Standard (BS8888), ISO Standards, International Building Code (IBC) and other local, regional and international codes to building and engineering drawings. This syllabus is designed to provide in depth knowledge, skills and competencies that are required for further studies and for the world of work. Through the use of authentic, learner-centred teaching and assessment approaches, students will develop twenty-first century skills such as creativity, communication, problem-solving, critical thinking and collaboration.

This syllabus will contribute to the development of the Ideal Caribbean Person, as articulated by the CARICOM Heads of Government, who: is emotionally secure with a high level of self-confidence and self-esteem; sees ethic, religious and other diversity as a source of potential strength and richness; is aware of the importance of living in harmony with the environment; values and displays the creative imagination in its various manifestations and nurtures its development in the economic and entrepreneurial spheres in all other areas of life and *demonstrate multiple literacies, independent and critical thinking; questions the beliefs and practices of past and present and brings this to bear on the innovative application of science and technology to problem-solving (Caribbean Education Strategy, 2000). Based on the UNESCO Pillars of Learning, this course of study will also contribute to a person who will learn to know, learn to do, learn to live with others, learn to be and learn to transform oneself and society.*

The Units, in the syllabus, integrate the principles of Competency-Based Education, Training and Assessment (CBETA) in the School-Based Assessment component. This strategy is consistent with the seamless articulation among ***CXC®****'s qualifications to facilitate an appropriate balance between the academic and technical subjects and to improve work-based performance.*

♦ AIMS

The syllabus *aims to:*

1. develop proficiency in *technical communication* and production of building and mechanical engineering drawings which conform to BS and ISO Standards, *IBC* and local, *regional and international* codes;

2. develop skills in the preparation of working and assembly drawings conforming to BS and ISO Standards, *IBC* and local, *regional and international* codes;

3. *develop an understanding of the properties, uses and production of materials used in the* manufacture of *building and* engineering components;

4. develop an understanding of how sustainable designs and sustainable energy can be incorporated and/or utilised in mechanical and building engineering designs;

5. provide knowledge of the different methods of production of building and engineering components;

6. *develop skills in communicating technical information using illustrations, scaled models and working drawings* to solve engineering *design* problems;

7. develop skills in applying and drawing principles to facilitate product development and manufacture;

8. develop *proficiency* in the use of Computer-Aided *Design* (CAD) software *and reference materials* to produce engineering drawings *and architectural drawings*;

9. develop an interest in *the built environment (architectural or* mechanical engineering) as disciplines and careers; and,

10. develop the capacity for research, critical and creative thinking, collaboration and problem-solving, through authentic learning experiences.

♦ SKILLS AND ABILITIES TO BE ASSESSED

The skills and abilities which students are expected to develop on completion of the syllabus have been grouped under three headings:

(a) Knowledge;

(b) Application; *and,*

(c) Drawing Skills.

Knowledge: The ability to identify, recall and grasp the meaning of fundamental facts, concepts and *Computer-Aided Design (CAD)-drawing* principles.

Application: The ability to use facts, concepts, principles and procedures in *authentic* situations; transform data accurately and appropriately; use common characteristics as a basis for classification; use formulae accurately for computations *to solve engineering and architectural issues*.

Drawing Skills: The ability to *use the Computer-Aided Design (CAD) interface correctly to* produce neatly organised and accurate drawings according to specification.

♦ PREREQUISITES OF THE SYLLABUS

It is expected that persons *who have completed* either the Building or Mechanical Engineering Drawing Option of the **CSEC®** Technical Drawing or Industrial Technology Syllabuses or the equivalent should be able to pursue this course of study. *However, successful participation in the* course *of study will also depend on the possession of good technical, verbal, written and communication skills.*

♦ STRUCTURE OF THE SYLLABUS

The syllabus is divided into two Units. Each Unit consists of three Modules. The Units are independent of each other. *The syllabus has two specific Options, Option A, Mechanical Engineering Drawing, and Option B, Building Drawing. Each Option in the syllabus is divided into two Units of 150 hours each. Each Unit consists of three Modules of 50 hours each. Each Module is compulsory*. Together they provide a comprehensive post-secondary course in the field of Building and Mechanical Engineering Drawing.

Unit 1: Building and Mechanical Engineering Drawing contains three Modules of approximately 50 hours each. *Unit 1 is designed to provide the students with an all-round development experience in building and engineering drawing. Candidates are required to complete Modules 1 and 2 which are compulsory and either Module 3A or Module 3B. The total time for the syllabus is approximately 150 hours.*

Module 1	-	Geometry 1
Module 2	-	Geometry 2
	Options	
Module 3A	-	*Engineering Drawing*
	OR	
Module 3B	-	*Building Drawing*

Unit 2: ***Building and Mechanical Engineering Drawing*** contains three Modules of approximately 50 hours each. The total time for the syllabus is approximately 150 hours. Unit 2 offers two options: Option A, *Mechanical Engineering Drawing and Design*, and Option B, *Building Drawing and Design*. Candidates are required to select **either** Option A **or** Option B. The total time for the syllabus is approximately 150 hours.

Option A: Mechanical Engineering Drawing and Design

Module 1	-	Mechanics of Machines
Module 2	-	Engineering Materials and Processes
Module 3	-	*Engineering Design Elements*

Option B: Building Drawing and Design

Module 1	-	Structural Drawings
Module 2	-	Building Materials and Processes
Module 3	-	*Management and Design*

♦ *APPROACHES TO TEACHING THE SYLLABUS*

*The syllabus will be facilitated through the use of Computer-Aided Design (CAD). For the effective teaching of the **CAPE®** Building and Mechanical Engineering Drawing Syllabus teachers are encouraged to provide opportunities for students to interact with experts from the built environment and mechanical engineering industry to observe industry practices. Activities used in the teaching of this Syllabus should mirror what obtains in the real- world environment thereby allowing students to work individually and with others as a group with its attendant activities – such as produce computer-aided scaled drawings and sketches for industry use, recognise uses of construction and engineering materials and identify best practices used in the industry.*

The specific objectives indicate the scope of the content and the activities that should be covered. Students should be exposed to accurate, unbiased content and skills that will foster creativity and problem solving thereby preparing citizens to participate in dynamic industries and the wider society. Therefore, the role of the teacher is to employ a collaborative, highly practical and industry-driven approach to facilitate students' learning.

♦ UNIT 1: BUILDING AND MECHANICAL ENGINEERING DRAWING

MODULE 1: *GEOMETRY 1*

GENERAL OBJECTIVES

On completion of this Module, students should:

1. *demonstrate proficiency in Computer-Aided Design (CAD) skills for the creation of two-dimensional drawings;*

2. *understand the principles to trace the path of a point in correct sequence for geometrical curves;*

3. *develop the centroid and moments of area for plane figures by integration; and,*

4. *demonstrate proficiency in the development of orthographic projections for given solids according to specifications.*

SPECIFIC OBJECTIVES	CONTENT
Students should be able to *use Computer-Aided Design (CAD) software to*:	
1. *apply the features of a Computer-Aided Design (CAD) software to produce drawings;*	Computer-Aided *Design* (CAD) (a) *Data entry methods such as polar, absolute, relative and direct co-ordinate methods.* (b) *Draw toolbar such as lines, polylines, spline and hatch.* (c) *Modify toolbar and drawing aids such as mirror, array, copy and rotate.* (d) *Dimension style settings such as linear, align, radius and diameter.* (e) *Drawing limits, units, layers, templates.* (f) *Plotting/printing, scaling, saving, sheeting.*
2. *construct plane figures;*	*Standard Geometrical Plane Figures* *Type of plane figures to include:* - *Polygons (triangles, quadrilaterals, five and more sides), circles and arcs.*

SPECIFIC OBJECTIVES	CONTENT
Students should be able to *use Computer-Aided Design (CAD) software to*:	
3. construct *the path of a point for specific geometrical curves;*	Standard *Geometrical* Curves (a) *Types of geometrical curves to include:* (i) *ellipse such as concentric circle, rectangle, foci and eccentricity method;* (ii) *parabola such as rectangle and eccentricity methods;* (iii) *hyperbola such as the eccentricity method;* (iv) *cycloids;* (v) *trochoids (inferior and superior);* (vi) *involutes;* (vii) *Archimedian spiral; and,* (viii) *link mechanism.* (b) *Constructing tangents to geometrical curves:* (i) Ellipse (ii) Parabola (iii) Hyperbola (iv) Cycloids (v) Involutes *(vi)* Archimedian spiral

UNIT 1
MODULE 1: *GEOMETRY 1* (cont'd)

SPECIFIC OBJECTIVES	CONTENT
Students should be able to *use Computer-Aided Design (CAD) software to*:	
4. determine centroids of plane figures by simple calculations;	Centroids*:* *(a) Lines of symmetry; and,* *(b) Vector geometry.*
5. *determine centroids and 1st and 2nd moments of area by graphical integration; and,*	*Integration of Areas* (a) *Construction of 1st and 2nd derived shape from a given figure.* (b) *Determination of the area of plane shape graphically.* (c) *Determination of the centroid, 1st and 2nd moments of areas, by applying formulae.*
6. *draw the orthographic projections for a given solid based on specifications*.	Orthographic Projection (a) *First angle projection* (b) *Third* angle projection

Suggested Teaching and Learning Activities

To facilitate students' attainment of the objectives of the Syllabus, teachers are advised to engage students in the teaching and learning activities below. These activities are designed to support a learner-centred, collaborative approach, and incorporate appropriate ICT tools where necessary while catering to students with various learning styles.

1. *Have students engage in activities to practice and master the fundamentals of Computer-Aided Design (CAD) (setup, use of draw and modify tool bars) are taught and mastered by the student at this level.*

2. *Have students visit drawing offices and architectural firms to observe the application and use of geometrical shapes for aesthetic and ergonomic features in mechanical and building drawings.*

3. *Have students conduct research and deliver presentations on application of geometrical shapes and constructions in mechanical and building drawing.*

Suggested Teaching and Learning Activities (cont'd)

4. *Have students brainstorm and present the benefits and challenges for the application of various geometrical shapes used locally, regionally and internationally.*

5. *Encourage students to use images and real models to identify uses of geometrical shapes and constructions in mechanical and building drawings.*

6. *Have students construct geometrical shapes incorporating positive and negative spaces and finding their areas analytically and graphically.*

7. *Encourage students to use step-by-step approaches with guided practice to ensure the highest level of analytical and graphical accuracy when constructing geometrical shapes and integrating their areas.*

8. *Invite experts to conduct guest lectures to address students on the relevance of finding the centre of gravity and the integration of areas in real life scenario. Students will then be required to journal on the lessons learnt from the lecture.*

9. *Coordinate Webinars/smart classroom on the construction of geometrical shapes and the integration of areas.*

10. *Collaborate utilising the flat classroom to facilitate lessons in building and mechanical drawing concepts using geometrical shapes.*

RESOURCES

Jackson, E.	*Advanced Level Technical Drawing, Third Edition. 1975.*
Jensen C., Helsel, J., and, Short, D.	*Engineering Drawing and Design.* New York: McGraw Hill Science, 2007.
Madsen, D. A.and, Madsen, D. P.	*Engineering Drawing and Design. USA: Delmar Cengage Learning, 2012.*
Morling, K.	*Geometric and Engineering Drawing. 2022.*

WEBSITE

https://www.mycadsite.com/

UNIT 1
MODULE 2: *GEOMETRY 2*

GENERAL OBJECTIVES

On completion of this Module, students should*:*

1. *demonstrate proficiency in Computer-Aided Design (CAD) skills for the creation of three-dimensional drawings; and,*

2. *understand how to navigate the 3-D environment using the Computer-Aided Design (CAD) software.*

SPECIFIC OBJECTIVES	CONTENT
Students should be able to *use Computer-Aided Design (CAD) software to*:	
1. represent solids in pictorial projections;	Pictorial Projections (a) Projections: (i) oblique; (ii) planometric; (iii) isometric *such as iso plane; and,* (iv) *perspective:* - *one-point angular; and,* - *two*-point angular. (b) *Draw* circles and curves in pictorial drawings.
2. project auxiliary views;	Auxiliary Views (a) The projection of sections of solids cut by inclined planes. (b) True shapes of sections. (c) First and second auxiliary views.

SPECIFIC OBJECTIVES	CONTENT
Students should be able to use *Computer-Aided Design (CAD) software to*:	
3. draw lines of intersection between solids;	Intersection and interpenetration of solids *such as spheres, cones, cylinders, pyramids and prisms*.
4. *produce* surface developments; *and,*	(a) Surfaces of right or skewed three-dimensional objects *such as cones, cylinders, pyramids and prisms*. (b) Surfaces composed of multiple geometric shapes. (c) Transition pieces (square-to-round, round-to-round). (d) Economical use of materials (seam line location).
5. *construct helices*.	Helix (a) *Helices on cylindrical forms (screw threads and springs).* (b) *Helices on conical forms.*

Suggested Teaching and Learning Activities

To facilitate students' attainment of the objectives of the Syllabus, teachers are advised to engage students in the teaching and learning activities below. These activities are designed to support a learner-centred, collaborative approach, and incorporate appropriate ICT tools where necessary while catering to students with various learning styles.

1. *Teachers should encourage students to use selected video tutorials and supporting activities to explore the fundamentals of Computer-Aided Design (CAD) (setup, use of draw and modify tool bars) and master the skills and competencies students are required to develop at this level.*

2. *Have students visit drawing offices and architectural firms to observe the application and use of geometrical shapes for aesthetic and ergonomic features in mechanical and building drawings.*

3. *Have students conduct research and deliver presentations on the application of geometrical shapes and constructions in mechanical and building drawing.*

Suggested Teaching and Learning Activities

4. *Have students brainstorm and present the benefits and challenges for the application of various geometrical shapes used locally, regionally and internationally.*

5. *Have students engage in activities that place emphasis on definitions, freehand sketching and different drawing methods.*

6. *Have students perform relevant calculations where required.*

7. *Encourage the use of images and real models to identify uses of solid geometrical shapes in mechanical and building drawings.*

8. *Have students use step-by-step approaches with guided practice to ensure the highest level of graphical accuracy when constructing solid geometrical shapes.*

9. *Co-ordinate Webinars/smart classroom and invite experts to conduct guest lectures to address students on the relevance of solid geometrical shapes in design.*

10. *Collaborate utilising the flat classroom to facilitate lessons in building and mechanical drawing concepts using solid geometrical shapes.*

RESOURCES

Jackson, E. — *Advanced Level Technical Drawing, Revised Metric Edition*. London: Longman Group Limited, 1975.

Jensen C., Helsel, J., and, Short, D. — *Engineering Drawing and Design.* New York: McGraw Hill Science, 2007.

Madsen, D. A., and, Madsen, D. P. — *Engineering Drawing and Design. USA: Delmar Cengage Learning, 2012.*

Morling, K. — *Geometric and Engineering Drawing. 2022.*

Shoukry, Y., &, Pandey, J. — *Practical Autodesk AutoCAD 2025 and AutoCAD LT 2025: A no-nonsense, beginner's guide to drafting and 3D modelling. 2025. (Please note that the software is upgraded yearly and it is recommended that we use the latest edition).*

UNIT 1
MODULE 3A: ENGINEERING *DRAWING*

GENERAL OBJECTIVES

On completion of this Module, students should:

1. *demonstrate proficiency in the use of Computer-Aided Design (CAD) software to produce engineering drawings*;

2. *understand the use of Computer-Aided Manufacturing (CAM) in engineering drawings; and,*

3. *demonstrate proficiency in the use of Computer-Aided Design (CAD) to produce proportional drawing/sketches to solve engineering problems.*

SPECIFIC OBJECTIVES	CONTENT
Students should be able to *use Computer-Aided Design (CAD) software to*:	
1. *produce annotated and dimensioned working* drawings of machine components for *manufacturing purposes;*	*Annotated and Dimensioning Drawings* (a) *General* (b) *Manufacturing (working drawings)* (c) *Geometric and positional tolerances: finishes, limits and fits (BS 4500)* (d) *Balloon referencing and parts listings:* (i) cross-reference; and, (ii) *parts* list*ing* and materials specification.
2. prepare drawings with sectional views;	*Drawings with Sectional Views* (a) *Machine components* (b) *Fasteners to include permanent and temporary*
3. *produce working and* assembly drawings;	Working and Assembly Drawings (a) Working drawings: (i) machine parts and components;

SPECIFIC OBJECTIVES	CONTENT
Students should be able to *use Computer-Aided Design (CAD) software to*:	
	(ii) *using fasteners,* machining symbols *and engineering conventions*; and,
	(iii) *drawing notations.*
	(b) Assembly drawings:
	- machine parts and components.
4. *construct displacement diagrams for edge, face and cylindrical in CAM;*	*Displacement Diagrams for CAM*
	(a) *CAM profiles and displacement diagrams to produce:*
	(i) *dwell;*
	(ii) *uniform velocity;*
	(iii) *uniform acceleration or retardation;* and,
	(iv) *simple harmonic motion.*
	(b) *CAM profiles and displacement diagrams with various types of followers, namely:*
	(i) *knife-edge;*
	(ii) *roller;*
	(iii) *flat;* and,
	(iv) *spherical.*
	(c) *CAM profiles and displacement diagrams with different follower paths:*
	(i) *straight line;*
	(ii) *circular arc;*

SPECIFIC OBJECTIVES	CONTENT
Students should be able to *use Computer-Aided Design (CAD) software to*:	
	(iii) *on-centre; and,* (iv) *off-centre.*
5. prepare detailed *proportional drawings/*sketches of machine parts and components; *and,*	*Proportional Drawing/*Sketching (a) Orthographic views of machine parts and components. (b) Pictorial views of machine parts and *components*. (c) *Transforming 2D drawings to 3D drawings.*
6. *synthesise* solutions to engineering problems.	(a) Accessories: (i) gauges; (ii) small tools; and, (iii) *holding* devices. (b) Mechanisms: (i) slide crank and pin; (ii) rack and pinion; and, (iii) ratchet. (c) *Temporary* Fasteners: (i) bolts and nuts; (ii) screws; (iii) studs; and, (iv) keys, pins, rivets and locking devices.

SPECIFIC OBJECTIVES **CONTENT**

Students should be able to *use Computer-Aided Design (CAD) software to*:

(d) Hydraulic Systems.

(e) Pumps:

(i) centrifugal; and,

(ii) reciprocating.

(f) Valves:

(i) non-return;

(ii) isolating;

(iii) expansion;

(iv) safety;

(v) gate; and,

(vi) globe.

(g) Piping and joints:

(i) flanged; and,

(ii) hydraulic.

(h) Seals:

(i) dynamic; and,

(ii) static.

SPECIFIC OBJECTIVES	CONTENT
Students should be able to *use Computer-Aided Design (CAD) software to*:	(i) Machines Parts of the following machines: (i) drilling; (ii) *measuring;* (iii) *marking;* (iv) *forming;* (v) *bending;* (vi) casting; (vii) grinding; (viii) lathe; (ix) milling; and, (x) shaping.

Suggested Teaching and Learning Activities

To facilitate students' attainment of the objectives of the Syllabus, teachers are advised to engage students in the teaching and learning activities below. These activities are designed to support a learner-centred, collaborative approach, and incorporate appropriate ICT tools where necessary while catering to students with various learning styles.

1. *Have students review* articles *from online sources and* current periodicals on relevant Mechanical Engineering topics *that will* assist students in adequately covering the design sections of the Module. *Students should then be asked to work in groups to present the lessons learnt to the whole class.*

2. Have students complete several working and assembly drawings of machine parts and components.

Suggested Teaching and Learning Activities

3. Place emphasis on the importance of sketching*/drawing in proportion to enable* students to become familiar with the complexity *of* the theory and construction of various machine parts and components. *Then ask students to prepare posters or information cards for inclusion in their portfolio or for a class display.*

4. *Have students v*isit mechanical engineering drawing offices to familiarise *themselves* with the different conventional representation*s of* drawings and the use and importance of drawing standards.

5. *Teachers to arrange* visits to machine and mechanical engineering workshops *and/or sites to view the components and parts of the systems* to familiarise students with the operations.

6. *Arrange for experts to present on trends in the field that have influenced changes in the way the industry operates*. *Have students make presentations on the three most important lessons learnt.*

7. *Teachers are encouraged to coordinate Webinars/smart classroom on engineering drawing and design and have students make short presentations in pairs on the top three lessons learnt from the Webinar/smart classroom session.*

8. *Teachers are encouraged to collaborate utilising the flat classroom to facilitate lessons in engineering drawing concepts. Student participation as experts on assigned concepts is highly encouraged.*

RESOURCES

Jackson, E. *Advanced Level Technical Drawing, Revised Metric Edition*. London: Longman Group Limited, 1975.

Jensen C., Helsel, J., and, Short, D. *Engineering Drawing and Design.* New York: McGraw Hill Science, 2007.

Kyles, S. R. AutoCAD Workbook for Architects and Engineers. Singapore: Blackwell Publishing, 2008.

Madsen, D. A., and, Madsen, D. P. Engineering Drawing and Design. USA: Delmar Cengage Learning, 2012.

Morling, K. Geometric and Engineering Drawing. 2022.

Shoukry, Y., &, Pandey, J. Practical Autodesk AutoCAD 2025 and AutoCAD LT 2025: A no-nonsense, beginner's guide to drafting and 3D modelling. 2025. (Please note that the software is upgraded yearly, and it is recommended that we use the latest edition).

UNIT 1
MODULE 3B: BUILDING DRAWING

GENERAL OBJECTIVES

On completion of this Module, students should:

1. *demonstrate proficiency in the use of Computer-Aided Design (CAD) to produce working drawings with construction details to national, regional and international building codes and standards; and,*

2. *demonstrate proficiency in the use of Computer-Aided Design (CAD) to produce orthographic and pictorial sketches.*

SPECIFIC OBJECTIVES	CONTENT
Students should be able to *use Computer-Aided Design (CAD) software to*:	
1. *produce a complete set of 2D and 3D working drawings using suitable scales;*	*2D and 3D Working Sketches or Drawings* (a) *Perspective* (b) *Exploded isometric* (c) *Orthographic*
2. *produce drawings with sectional views according to building codes and standards; and,*	*Drawings with Sectional Views* *Sectional views of:* (a) *a flat roof (concrete and timbers);* (b) *joint details in windows and doors; and,* (c) *building codes and standards such as CARICOM Regional Energy Efficiency Building Code (CREEBC), Caribbean Disaster Emergency Management Agency (CDEMA), Caribbean Uniform Building Code (CUBiC), OECS Building Codes, Jamaica, Barbados, Trinidad and Tobago, Belize, and Guyana National Building Codes, ISO standards, BS Standards.*
3. *produce orthographic drawings.*	*Orthographic* Drawings (a) *Floor Plans:* (i) *two storey buildings using appropriate scales:*

SPECIFIC OBJECTIVES **CONTENT**

Students should be able to *use Computer-Aided Design (CAD) software to*:

- *residential (single dwelling);*
- *split-level structure;*
- *townhouse/apartment; and,*
- *commercial building.*

(ii) *buildings outfitted with access for the physically challenged;*

(iii) *window and door schedules; and,*

(iv) *positioning of windows and doors, types of materials, ventilation.*

(b) *Roof plans:*

(i) *gable or v-shaped roof;*

(ii) *hip roof;*

(iii) *bow string or dome roof;*

(iv) *reinforced concrete roof; and,*

(v) *energy-efficient roof covering.*

(c) *Elevations and sectional elevations for two-storey building:*

(i) *east elevation;*

(ii) *west elevation;*

(iii) *north elevation;*

(iv) *south elevation;*

(v) *longitude; and,*

(vi) *offset sections.*

SPECIFIC OBJECTIVES **CONTENT**

Students should be able to *use Computer-Aided Design (CAD) software to*:

(d) *Site plans:*

(i) *orientation of building on site;*

(ii) *setback dimension from building to boundaries;*

(iii) *septic tank and soak away pit/ sewer system waste line, reed beds, tile fields;*

(iv) *drainage (surface and main drain);*

(v) *north position;*

(vi) *driveway, lawn and vegetation;*

(vii) *commercial parking (design and types);*

(viii) *loading and off-loading bay;*

(ix) *handrail from car park to building; and,*

(x) *walkway from car park to building.*

(e) *Location plans:*

(i) *street names;*

(ii) *business places;*

(iii) *electricity poles; and,*

(iv) *landmarks.*

SPECIFIC OBJECTIVES **CONTENT**

Students should be able to *use Computer-Aided Design (CAD) software to*:

(f) *Staircase (timber)*

Types:

(i) *Straight flight:*

- *with landing;*

(ii) *'U' Shape;*

(iii) *L- flight;*

(iv) *Spiral; and,*

(v) *Joints.*

(g) *Foundation Plans:*

(i) *footing details;*

(ii) *strip footing;*

(iii) *pad footing; and,*

(iv) *pile footing.*

(h) *Ground Beam Details*

(i) *Ground floor slab plan and details*

(j) *Electrical:*

(i) *symbols and components;*

(ii) *layouts (positioning of fixtures and fittings);*

(iii) *types of lighting fixtures (for example LED, solar-powered); and,*

(iv) *smart fixtures.*

SPECIFIC OBJECTIVES **CONTENT**

Students should be able to *use Computer-Aided Design (CAD) software to*:

(k) *Plumbing:*

(i) *fixtures and fittings;*

(ii) *flow diagrams and symbols;*

(iii) *pipe drawing layouts;*

(iv) *sewer line diagram; and,*

(v) *smart fixtures (water-saving devices, smart flush toilets, touch-less faucets).*

Suggested Teaching and Learning Activities

To facilitate students' attainment of the objectives of the Syllabus, teachers are advised to engage students in the teaching and learning activities below. These activities are designed to support a learner-centred, collaborative approach, and incorporate appropriate ICT tools where necessary while catering to students with various learning styles.

1. *Have students visit the Town and Country Planning office for policies and regulations on National Building Codes and Standards (with a focus on Two Story Buildings) and have students use the policies to evaluate drawings.*

2. *Have students visit the local Environmental office to obtain ideas on mitigation strategies when building in the natural environment; then have them work in groups to create a brochure or pamphlet or jingle to be shared with the class.*

3. *Have students research and deliver presentations on topics contained in the Module.*

4. *Have students visit construction sites (residential and commercial) to observe the use and application of construction materials.*

5. *Have students visit drawing offices, architectural firms, construction companies and/or sites that uses the various sustainable energy technologies to observe the process in which drawings are produced as well as new, emerging and greening building and construction technologies.*

6. *Have students complete drawings for buildings to include building orientation on site, energy-saving fixtures and fittings, photovoltaic panels, wind turbines.*

7. *Invite experts to conduct guest lectures to address students on the relevant regional building codes/ standards to include those for energy. Students will then be required to journal on the lessons learnt from the lecture.*

Suggested Teaching and Learning Activities (cont'd)

8. *Teachers are encouraged to coordinate Webinars/smart classroom on sustainable building design and drawing.*

9. *Teachers are encouraged to collaborate utilising the flat classroom to facilitate lessons in building drawing concepts.*

RESOURCES

Chudley, R., and, Green, R. — *Construction Technology, 4th edition*. Essex: Pearson Prentice Hall, 2005.

Krishna, N. — *Structural Design and Drawing: Reinforced Concrete and Steel.* Chicago: Universities Press, 2005.

Kubba, D. — *Blue Print Reading: Construction Drawing for the Building Trade.* New York: McGraw Hill, 2008.

Kyles, S. R. — *AutoCAD Workbook for Architects and Engineers. Singapore: Blackwell Publishing, 2008.*

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Morling, K. — *Geometric and Engineering Drawing. 2022.*

Newton, P. — *Structural Detailing: For Architecture, Building and Civil Engineering Students (Building and Surveying Series) 2nd edition*. London: Macmillan Publisher, 1991.

Shoukry, Y., &, Pandey, J. — *Practical Autodesk AutoCAD 2025 and AutoCAD LT 2025: A no-nonsense, beginner's guide to drafting and 3D modelling. 2025. (Please note that the software is upgraded yearly, and it is recommended that we use the latest edition).*

WEBSITE

https://www.mycadsite.com/

♦ UNIT 2: BUILDING AND MECHANICAL ENGINEERING DRAWING

2A: MECHANICAL ENGINEERING DRAWING AND DESIGN
MODULE 1: MECHANICS OF MACHINES

GENERAL OBJECTIVES

On completion of this Module, students should:

1. *understand* the characteristics of the operating principles of the mechanics of machines;
2. develop the ability to communicate, graphically and visually, the fundamentals of mechanics in different machine components using Computer-Aided methods*; and,*
3. *understand the principles of lines and planes in space.*

SPECIFIC OBJECTIVES	CONTENT
Students should be able to *use Computer-Aided Design (CAD) software to*:	
1. determine forces in structures using *the analytical* method;	*Determination of Forces- Analytical method* (a) Triangle, parallelogram and polygon of forces to find: (i) resultant equilibrium; *and,* (ii) resolution of forces in members *such as simple frames, levers and pulleys.*
2. construct shear force and bending moment diagrams;	*Beams* (a) Types of beams: (i) *simply supported:* - *point load; and,* - *uniformly distributed load.* (ii) *cantilever.* (b) Beam sign conventions (c) *Shear Force Diagram (SFD)* (d) Bending Moment Diagram (BMD)

2A: MECHANICAL ENGINEERING DRAWING AND DESIGN
MODULE 1: MECHANICS OF MACHINES (cont'd)

SPECIFIC OBJECTIVES	CONTENT
Students should be able to *use Computer-Aided Design (CAD) software to*:	
3. calculate the various parameters of the involute spur gears; *and,*	*Involute Spur* Gears (a) Defini*tion of* terms: (i) pitch circle diameter; (ii) pitch point; (iii) pressure angle; (iv) addendum; (v) dedendum; (vi) clearance; (vii) circular pitch; (viii) circular tooth thickness; (ix) number of teeth; (x) diametrical pitch; (xi) module; (xii) *base circle diameter*; *and,* (xiii) *root diameter.* (b) Calculati*on of* parameters necessary to construct gear tooth profiles. (c) Construction of gear tooth profiles by involute and approximate methods. (d) Construction of gear tooth in mesh. (e) Using ISO conventional systems and British Standards (BS 8888).

2A: MECHANICAL ENGINEERING DRAWING AND DESIGN
MODULE 1: MECHANICS OF MACHINES (cont'd)

SPECIFIC OBJECTIVES	CONTENT
Students should be able to *use Computer-Aided Design (CAD) software to*:	
4. locate lines and planes in space.	Lines and Planes in Space (a) True angles between intersecting lines. (b) True angles between intersecting planes. (c) True angles between lines and planes. (d) Traces of lines on planes. (e) Traces of planes on planes. (f) Traces of perpendicular planes and their inclination to the planes of reference. (g) Skewed lines *(finding the shortest distance between two lines)*.

Suggested Teaching and Learning Activities

To facilitate students' attainment of the objectives of the Syllabus, teachers are advised to engage students in the teaching and learning activities below. These activities are designed to support a learner-centred, collaborative approach, and incorporate appropriate ICT tools where necessary while catering to students with various learning styles.

1. *Teachers are encouraged to arrange visits to* Mechanical Engineering Drawing Offices *and mechanical engineering workshops,* to familiarise students with the different conventional representation on drawings and the use and importance of drawing standards.

2. Have students research and deliver presentations on topics contained in the Module.

3. *Have students brainstorm and present the benefits and challenges for the use and application of various forces acting on simple framework.*

4. *Encourage the use of images and real models to identify the application and use of gears in mechanical engineering devices.*

2A: MECHANICAL ENGINEERING DRAWING AND DESIGN
MODULE 1: MECHANICS OF MACHINES (cont'd)

Suggested Teaching and Learning Activities (cont'd)

5. *Have students engage in individual and group activities to practice the fundamentals of Computer-Aided Design (CAD) (setup, use of draw and modify tool bars) to ensure these are mastered by the student at this level.*

6. *Have students solve problems using lines and planes in space.*

7. *Coordinate Webinars/ smart classroom and invite experts to conduct guest lectures to address students on the relevance of resolution of forces in members of simple framework.*

8. *Collaborate utilising the flat classroom to facilitate lessons in the fundamentals of mechanics of machines.*

RESOURCES

Abbott, W.	*Practical Geometry Engineering Graphics. 8th Edition 1989.*
Jackson, E.	*Advanced Level Technical Drawing, Revised Metric Edition*. London: Longman Group Limited, 1975.
Jensen C., Helsel, J., and, Short, D.	*Engineering Drawing and Design.* New York: McGraw Hill Science, 2007.
Morling, K.	*Geometric and Engineering Drawing. 2022.*
Shoukry, Y., &, Pandey, J.	*Practical Autodesk AutoCAD 2025 and AutoCAD LT 2025: A no-nonsense, beginner's guide to drafting and 3D modelling. 2025. (Please note that the software is upgraded yearly, and it is recommended that we use the latest edition).*

2A: MECHANICAL ENGINEERING DRAWING AND DESIGN
MODULE 2: ENGINEERING MATERIALS AND PROCESSES

GENERAL OBJECTIVES

On completion of this Module, students should:

1. *understand how to select appropriate materials for the manufacturing of engineering components;*
2. *develop an understanding of the manufacturing processes of engineering components;*
3. *appreciate sustainable energy sources used in the manufacturing processes of engineering components;*
4. *develop proficiency in the use and application of various types of engineering components; and;*
5. *demonstrate an understanding of occupational health and safety requirements.*

SPECIFIC OBJECTIVES	CONTENT
Students should be able to:	
1. *select appropriate materials for the manufacturing of engineering components;*	Materials (a) Metals: (i) ferrous *to include* wrought iron, cast iron, carbon steel, stainless steel); and, (ii) non-ferrous *to include* copper, aluminium, brass and other alloys). (b) Plastics: (i) thermoplastic – polyvinyl chloride (PVC), polytetrafluroethylene (fluorocarbons), polyethylene, polystyrene, polypropylene, polyamides (Nylon), polymethylmethacrylate (Perspex); and, (ii) thermosetting – epoxy-resin (bakelite, melamine), laminates (tufnol, formica).

SPECIFIC OBJECTIVES	CONTENT
Students should be able to:	
	Materials (c) Rubber: (i) characteristics (organic, silicone, synthetic); and, (ii) uses and applications.
2. *evaluate the appropriate manufacturing processes for various types of engineering components;*	Manufacturing *Processes for Engineering Components* (a) Machining Tool Operations – turning, shaping, drilling, milling, cutting and grinding (b) Casting – sand, die, investment (c) Fabrication: (i) welding – Shielded Metal Arc Welding (SMAW), Oxyfuel Gas Welding (OFW), Gas Tungsten-Arc Welding (GTAW or TIG), Gas Metal Arc Welding (GMAW or MIG), Laser Beam Welding (LBW), Resistance Spot Welding (RSW); (ii) welding symbols and their application; (iii) riveting – cold, hot, pop; and, (iv) sheet metal work – grooved seam, rolling and bending.
3. *explain the use of sustainable energy sources in the manufacturing processes for various types of engineering components;*	(a) *Sustainable Energy Sources in the manufacturing process:* (i) *Liquefied Natural Gas (LNG);* (ii) *Wind power;*

SPECIFIC OBJECTIVES	CONTENT
Students should be able to:	
	(iii) *Hydroelectric power;* (iv) *Solar power; and,* (v) *Renewable energy/biomass.* (b) *Uses including: electricity generation, heating, moulding, cooling, ventilation.*
4. *solve problems requiring knowledge of the application of bearings and bushings;*	Bearings and Bushings (a) Types of bearings and their functions: (i) ball – radial, thrust, angular contact, self-aligning, single/double row; (ii) roller – cylindrical (radial, thrust), tapered, spherical, needle; and, (iii) journal – pillow block, self-lubricating. (b) *Application of bearings in:* (i) *rotational and linear movements;* (ii) *handling stresses;* and, (iii) *reduction of friction.* (c) *Types of bushings:* (i) *sleeve;* (ii) *flanged;* (iii) *self-lubricating; and,* (iv) *dowel.*

SPECIFIC OBJECTIVES	CONTENT
Students should be able to:	
	(d) *Application of bushings:* (i) *bush – drill, sleeve (tolerances);* (ii) *reduction of friction;* (iii) *reduction of wear;* and, (iv) *mounting.*
5. *solve problems requiring knowledge of the application of seals and lubricants; and,*	Seals and Lubricants (a) Types of seals: (i) static – gasket, o-ring; and, (ii) dynamic – labyrinth, split ring, 'U', garter spring, o-ring. (b) Types of lubricants: (i) liquid; (ii) solid; and, (iii) gas. (c) *Application of seals:* (i) *preventing leaks;* (ii) *providing an airtight vacuum;* (iii) *containing pressure;* (iv) *keeping out contaminants; and,* (v) *reducing frictions.*

SPECIFIC OBJECTIVES	CONTENT
Students should be able to:	
	(d) Applications of lubricants: (i) liquid – splash, pressurised; (ii) solid; and, (iii) gas (mist, air).
6. *comply with occupational health and safety requirements.*	*Occupational health and safety requirements:* (a) *personal protective equipment (PPE): hard hats, safety goggles, ear protection, safety gloves, hard boots, protective clothing;* (i) *safety signs and symbols on manufacturing site;* (ii) *safety equipment and material;* (iii) *safety procedures and processes in manufacturing; and,* (iv) *designing for safety in manufacturing.*

Suggested Teaching and Learning Activities

To facilitate students' attainment of the objectives of the Syllabus, teachers are advised to engage students in the teaching and learning activities below. These activities are designed to support a learner-centred, collaborative approach, and incorporate appropriate ICT tools where necessary while catering to students with various learning styles.

1. *Teachers are encouraged to present* examples of components made from the manufacturing processes and materials in *the* Module. *Have students compare finishes and textures and document their findings in an electronic portfolio/ cloud storage*.

2. Have students prepare *collaborative* presentations that will showcase the processes involved from the drawing stage to the actual production of the component.

3. Have students visit machine and mechanical engineering workshops to familiarise themselves with the various machine-tools, equipment and sub-assembly components being repaired.

2A: MECHANICAL ENGINEERING DRAWING AND DESIGN
MODULE 2: ENGINEERING MATERIALS AND PROCESSES (cont'd)

Suggested Teaching and Learning Activities (cont'd)

4. Have students visit engineering plants/factories to observe the manufacture of components/products using the various processes, *sustainable energy sources* and materials in the Module.

5. Have students research and make presentations on topics contained in the Module.

6. *Have students conduct research on various types of sustainable energy sources used in the manufacturing of engineering components.*

7. *Invite experts to conduct guest lectures to address students on the relevance of selections and categorization of materials and manufacturing processes in addition to understanding the application of the sustainable energy technology used regionally and internationally. Students will then be required to journal on the lessons learnt from the lecture.*

8. *Teachers are encouraged to coordinate Webinars/smart classroom on mechanical engineering design and drawing.*

9. *Teachers are encouraged to collaborate utilising the flat classroom to facilitate lessons in building drawing concepts.*

RESOURCES

Jensen C., Helsel, J., and, Short, D. *Engineering Drawing and Design.* New York: McGraw Hill Science, 2007.

Morling, K. *Geometric and Engineering Drawing. 2022.*

Shoukry, Y., &, Pandey, J. *Practical Autodesk AutoCAD 2025 and AutoCAD LT 2025. A no-nonsense, beginner's guide to drafting and 3D modelling. 2025. (Please note that the software is upgraded yearly and it is recommended that we use the latest edition).*

2A: MECHANICAL ENGINEERING DRAWING AND DESIGN
MODULE 3: ENGINEERING DESIGN ELEMENTS

GENERAL OBJECTIVES

On completion of this Module, students should*:*

1. *develop the proficiency to synthesise and modify designs using various elements of power transmission;*

2. demonstrate *proficiency* in the *preparation* of sketches and drawings of machine components suitable for different manufacturing processes *using Computer-Aided Design (CAD)*;

3. *understand the design process;*

4. *demonstrate proficiency in the creation of designs of machine parts and components; and,*

5. *be aware of sustainable energy sources in the creation of designs of machine parts and components.*

SPECIFIC OBJECTIVES	CONTENT
Students should be able to:	
1. solve problems requiring knowledge of various elements of power transmission;	*Elements of* Power Transmission (a) Couplings: (i) rigid; (ii) flange; (iii) fluid; (iv) *oldham;* (v) *universal joint; and,* (vi) *cross and bearing.* (b) Gears: (i) spur; (ii) helical; (iii) bevel; *and,* (iv) worm.

SPECIFIC OBJECTIVES	CONTENT
Students should be able to:	
	(c) Belt drives: (i) vee; *and,* (ii) flat and toothed (tensioning of belts, fixed and movable shafts).
	(d) *Chain drives:* (i) *roller;* (ii) *inverted tooth/silent; and,* (iii) *tensioning of chain.*
	(e) Brakes: (i) single shoe; (ii) double shoe; *and,* (iii) internal drum disc.
	(f) Clutches: (i) single plate; (ii) multi-plate; *and,* (iii) centrifugal.
2. *prepare* sketches and *engineering* drawings of machine components *using Computer-Aided Design (CAD)*;	Sketches *and drawings* of machine Components: (a) *Fasteners.* (b) *Locking devices.* (c) *Keys, keyways, splines.* (d) *Shaft coupling.* (e) *Bearings.*

SPECIFIC OBJECTIVES	CONTENT
Students should be able to:	
	(f) *Pistons, connecting rods and crankshafts.*
	(g) *Hole preparations – countersink, counter bore.*
3. discuss the stages in the design process;	*Stages in the* Design Process
	(a) Recognition of need
	(b) Definition of problem
	(c) Synthesis
	(d) Analysis and optimisation
	(e) Evaluation
	(f) Presentation
4. explain the principles of design;	The Principles of Design
	(a) Elements:
	(i) *material selection;*
	(ii) materials specification;
	(iii) manufacturing processes; *and,*
	(iv) size and shape.
	(b) Aesthetics
	(c) Ergonomics:
	- *human machine relationships, for example, control loops, mouse.*
	(d) Cost

2A: MECHANICAL ENGINEERING DRAWING AND DESIGN
MODULE 3: ENGINEERING DESIGN ELEMENTS (cont'd)

SPECIFIC OBJECTIVES	CONTENT
Students should be able to:	
5. *create* designs of machine parts and components; *and,*	Design *Elements for Machine Parts and Components:* (a) Casting (b) Machining (c) Fabrication
6. *identify sustainable energy sources that can be used in the design of machine parts and components.*	*Sustainable energy sources:* (a) *Wind power;* (b) *Solar power;* (c) *Hydropower; and,* (d) *Biomass/Renewable energy power.*

Suggested Teaching and Learning Activities

To facilitate students' attainment of the objectives of the Syllabus, teachers are advised to engage students in the teaching and learning activities below. These activities are designed to support a learner-centred, collaborative approach, and incorporate appropriate ICT tools where necessary while catering to students with various learning styles.

1. Use articles *including online sources and* current periodicals on relevant Mechanical Engineering topics to assist students in adequately covering the content in the Module.

2. Have students complete a number of working and assembly drawings of various engineering *devices*.

3. Place emphasis on the importance of freehand sketching to enable students to become familiar with the differences in the theory and construction of various devices.

4. *Arrange for visits to Mechanical Engineering Drawing Offices, mechanical engineering workshops and/or sustainable energy sites to familiarise students with the design and creation of machine parts and components.*

5. *Arrange for experts to present on trends in the field that have influenced changes in the way the industry operates to include the use of sustainable energy sources. Have students journal the three most important lessons learnt.*

Suggested Teaching and Learning Activities (cont'd)

6. *Have students conduct research and present on various sustainable energy sources used in the design of machine parts and components.*

7. *Co-ordinate Webinars/smart classroom on sustainable building drawing and design.*

8. *Collaborate utilising the flat classroom to facilitate lessons in building drawing concepts.*

RESOURCES

Jackson, E.	*Advanced Level Technical Drawing, Revised Metric Edition. London: Longman Group Limited, 1975.*
Jensen C., Helsel, J., and, Short, D.	*Engineering Drawing and Design.* New York: McGraw Hill Science, 2007.
Morling, K.	Geometric and Engineering Drawing, 2022.
Shoukry, Y., &, Pandey, J.	*Practical Autodesk AutoCAD 2025 and AutoCAD LT 2025: A no-nonsense, beginner's guide to drafting and 3D modelling. 2025. (Please note that the software is upgraded yearly and it is recommended that we use the latest edition).*
Szekely, G.	*Sustainable Process Engineering. Harvard University Press, 2021.*

2B: BUILDING DRAWING AND DESIGN
MODULE 1: STRUCTURAL DRAWINGS

GENERAL OBJECTIVES

On completion of this Module, students should:

1. *understand the principles underlying the design and preparation of the types of structural drawings using Computer-Aided Design (CAD) methods;*

2. *demonstrate proficiency in designing structural drawing plans and layouts of various types of timber, concrete and steel structures in accordance with structural building codes;*

3. *understand the concept of sustainable building design; and,*

4. *appreciate the importance of sustainable energy principles in sustainable building designs.*

SPECIFIC OBJECTIVES	CONTENT
Students should be able to *do the following using Computer-Aided Design (CAD)*:	
1. *determine forces in structures using an analytical method;*	*Analytical Method* (a) *Triangle, parallelogram and polygon of forces to find:* (i) *resultant equilibrium; and,* (ii) *resolution of forces in members of simple frames.*
2. *construct shear force and bending moment diagrams;*	*Beams* (a) *Types of beams:* (i) *simply supported;* (ii) *cantilever/overhanging; and,* (iii) *continuous.* (b) *Beam sign conventions.* (c) *Shear force diagram (SFD) and bending moment (BMD).*

SPECIFIC OBJECTIVES	CONTENT
Students should be able to *do the following using Computer-Aided Design (CAD)*:	
3. create detailed sketches of structural drawings;	*Detailed sketches:* (a) *Pile plan with grid lines:* (i) *pile plan layout; and,* (ii) *detail section through pile foundation.* (b) *Column plan with grid lines:* (i) *column plan layout with grid lines;* (ii) *column detail; and,* (iii) *section through column.*
4. produce a complete set of structural drawings *to a* suitable scale;	*Structural Drawings:* (a) *Beam and column plan:* (i) *structural beam framing plan layout; and,* (ii) *Structural details of each beam.* (b) *Reinforced concrete plan:* (i) *first floor slab plan; and,* (ii) *sectional drawing through reinforced concrete first floor slab.* (c) *Roof Plan:* (i) *gable;* (ii) *hip;* (iii) *reinforced concrete roof slab; and,* (iv) *insulated material for energy efficiency such as foam.*

SPECIFIC OBJECTIVES **CONTENT**

Students should be able to *do the following using Computer-Aided Design (CAD)*:

(d) *Structural connection details:*

(i) *corner wall stiffeners detail;*

(ii) *corner junctions (L and T) wall stiffener details;*

(iii) *details of ground, lintel and ring beams; and,*

(iv) *box drain and slipper drain.*

(e) *Sewage treatment systems:*

(i) *plan of septic tank and soak-a-way pit;*

(ii) *sectional elevation through septic tank and soak away pit;*

(iii) *plan of reed bed and tile field; and,*

(iv) *sectional elevation through reed bed and tile field.*

(f) *Staircase Layout:*

(i) *straight flight:*

- *with landing;*

(ii) *'U' Shape;*

(iii) *L flight; and,*

(iv) *spiral.*

SPECIFIC OBJECTIVES	CONTENT
Students should be able to *do the following using Computer-Aided Design (CAD)*:	
	(g) *Wooden structures:* (i) *floors;* (ii) *ceiling; and,* (iii) *walls.*
5. *discuss the concept of sustainable building design; and,*	*Sustainable design concept:* (a) *Definition of sustainable building design* (b) *Elements of sustainable design such as:* (i) *durability;* (ii) *energy efficiency/sustainable energy;* (iii) *solar photovoltaic panels;* (iv) *waste reduction;* (v) *indoor air quality;* (vi) *water conservation; and,* (vii) *sustainable building materials.* (c) *Benefits and Challenges*
6. *analyse the importance of sustainable energy principles in building designs.*	*Sustainable energy design principles such as:* (a) *energy conservation;* (b) *energy efficiency;* (c) *responsible energy use;* (d) *respect for the environment; and,* (e) *site potential optimisation.*

2B: BUILDING DRAWING AND DESIGN
MODULE 1: STRUCTURAL DRAWINGS (cont'd)

Suggested Teaching and Learning Activities

To facilitate students' attainment of the objectives of the Syllabus, teachers are advised to engage students in the teaching and learning activities below. These activities are designed to support a learner-centred, collaborative approach, and incorporate appropriate ICT tools where necessary while catering to students with various learning styles.

1. *Use articles from current periodical on relevant architectural drawing topics to assist students in adequately covering the content in the Module.*

2. *Have students complete a number of working and assembly drawings of various structural components.*

3. *Place emphasis on the importance of sketching to enable students to become familiar with the differences in the theory and construction of building structures.*

4. *Have resource persons conduct seminars and webinars relating to topics on this module.*

5. *Have students make presentations and conduct peer review.*

6. *Have students visit drawing offices, architectural firms, construction companies and/or sites to observe the process in which drawings* are *produced including those involve in sustainable building design.*

7. *Have students conduct research on various elements of sustainable building design.*

8. *Have students brainstorm then present the benefits and challenges associated with the use and application of sustainable building design.*

9. *Have students complete drawings for buildings incorporating sustainable building design features with a focus on sustainable energy.*

10. *Invite experts to conduct guest lectures to address students on the relevant regional building codes/standards to include those for sustainable energy. Students will then be required to journal on the lessons learnt from the lecture.*

11. *Discuss with students how buildings designs could be modified to include sustainable building design elements including the sustainable energy component.*

12. *Co-ordinate Webinars/smart classroom on sustainable building design and drawing.*

13. *Collaborate utilising the flat classroom to facilitate lessons in building design concepts.*

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Ching, F. D. K.	*Architectural Graphics. 4th ed. New York, NY: John Wiley & Sons, Inc., 2003.*
Chudley, R., and, Greeno, R.	*Construction Technology, 4th edition*. Essex: Pearson Prentice Hall, 2005.
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2B: BUILDING DRAWING AND DESIGN
MODULE 2: BUILDING MATERIALS AND PROCESSES

GENERAL OBJECTIVES

On completion of this module, students should:

1. *understand the uses, properties and production of construction materials to satisfy specifications of construction processes in building designs;*

2. *develop an appreciation of the processes and equipment used in the application of building materials; and,*

3. *understand the fundamental principles of construction management.*

SPECIFIC OBJECTIVES	CONTENT
Students should be able to:	
1. *discuss the use of various types of construction materials;*	*Types of Construction Materials* (a) *Sand* (b) *Bricks* (i) *common;* (ii) *adobe;* (iii) *facing; and,* (iv) *engineering.* (c) *Blocks:* (i) *concrete; hempcrete, timbercrete;* (ii) *stone; and,* (iii) *clay.* (d) *Foam systems* (e) *Timber* (f) *Bamboo*

SPECIFIC OBJECTIVES	CONTENT
Students should be able to:	
	(g) *Cork*
	(h) *Paint:*
	(i) *solvent;*
	(ii) *primer;*
	(iii) *undercoat;*
	(iv) *finishing;*
	(v) *rubberised; and,*
	(vi) *rust proofing.*
	(i) *Plastics:*
	(i) *thermoplastics, for example, conduits, drain, waste, vents, sidings;*
	(ii) *recycled plastic; and,*
	(iii) *thermosetting plastic, for example, laminates, electrical fixtures.*
	(j) *Glass*
	(k) *Smart glass*
	(l) *Photovoltaic panels*
	(m) *Cement:*
	(i) *ordinary Portland cement (OPC);*
	(ii) *relative humidity Portland cement (RHPC);*

SPECIFIC OBJECTIVES	CONTENT
Students should be able to:	
	(iii) *sulfate resistant Portland cement (SRPC); and,* (iv) *coloured Portland cement.* (n) *Aggregates* (o) *Concrete* (p) *Plaster* (q) *Steel* (r) *Tiles* (s) *Rubber*
2. *discuss common properties associated with building construction materials;*	*Common Properties of Construction Materials* *Definitions and characteristics of:* (a) *thermal expansion;* (b) *thermal conductivity;* (c) *thermal resistance;* (d) *strength and stress;* (e) *deformation;* (f) *strain;* (g) *creep; and,* (h) *elasticity and plasticity.*

SPECIFIC OBJECTIVES	CONTENT
Students should be able to:	
3. *analyse the properties of different types of building construction materials;*	*Analysing Types of Construction Materials* *Types and testing procedures and findings of materials such as:* (a) *concrete (stressed and pre-stressed) to include slump test and compressive test;* (b) *cement;* (c) *aggregates:* - *sieve analysis;* - *cleanness test;* - *silt test; and,* - *moisture content.* (d) *concrete blocks;* (e) *pre cast concrete slabs;* (f) *cork;* (g) *straw bales;* (h) *recycled wood;* (i) *hempcrete;* (j) *timbercrete;* (k) *smart glass;* (l) *glass;* (m) *recycled plastic;* (n) *bamboo;* (o) *clay blocks; and,* (p) *steel.*

SPECIFIC OBJECTIVES	CONTENT
Students should be able to:	
4. *select suitable materials and their symbols for use in the design of different building structures;*	*Types of Materials for Building Structures* (a) *Footing walls such as stone, brick, concrete, hempcrete, timbercrete.* (b) *Floors such as wood, engineered wood, bamboo, laminates.* (c) *Ceilings such as wood, concrete, glass, smart glass.* (d) *External walls such as concrete, brick, adobe brick, hempcrete, timbercrete.* (e) *Partition/internal walls such as composites, wood, concrete, glass, drywall, bamboo.* (f) *Roofs such as wood, engineered wood, recycled wood, concrete, hempcrete, timbercrete, metal, steel, asphalt, solar tiles.* *(Refer to building code and other resources on material symbols).*
5. *outline the processes involved in the production of common building construction materials;*	*Building Construction Processes* (a) *Preparing and applying concrete* (b) *Rendering/plastering* (c) *Plumbing* (d) *Screeding* (e) *Electrical wiring* (f) *Landscaping* (g) *Insulation*

SPECIFIC OBJECTIVES	CONTENT
Students should be able to:	
6. *explain the functions of common construction equipment;*	*Construction Equipment* (a) *Excavator* (b) *Tractor* (c) *Backhoe* (d) *Bulldozer* (e) *Grader* (f) *Wheel loader* (g) *Articulated trucks* (h) *Compactors*

Suggested Teaching and Learning Activities

To facilitate students' attainment of the objectives of the Syllabus, teachers are advised to engage students in the teaching and learning activities below. These activities are designed to support a learner-centred, collaborative approach, and incorporate appropriate ICT tools where necessary while catering to students with various learning styles.

1. *Use real life examples of components made from the manufacturing processes and materials in Module. Have students select from the examples and prepare presentations that will showcase the processes involved from the drawing stage to the actual production of the component.*

2. *Have students visit a manufacturing plant, construction site and/or hardware store to familiarise them with the various tools, materials, equipment and processes.*

3. *Invite experts to engage students in demonstrations and discussions on new and emerging green technologies in the industry. Have students make presentations on the three most interesting lessons they learnt from the session.*

4. *Utilise a blended classroom approach of instruction using online collaborative tools. Have students research and make presentations on topics contained in the Module. Have students watch educational videos relating to tests done on construction materials.*

Suggested Teaching and Learning Activities (cont'd)

5. *Have students conduct research on construction materials analysis.*

6. *Have students brainstorm then present the benefits and challenges of using the various construction materials and their properties/characteristics.*

7. *Have students do a suitability chart of the various building structures and the associated construction materials.*

8. *Invite experts to conduct guest lectures to address students on new and emerging green technologies relating to construction materials. Students will then be required to journal on the lessons learnt from the lecture.*

9. *Co-ordinate Webinars/ smart classroom on sustainable building designs and processes with an emphasis on types of building structures and material use.*

10. *Collaborate utilising the flat classroom to facilitate lessons in building materials and processes.*

RESOURCES

Allen, E., and, Joseph I. — *Fundamentals of Building Construction: Materials and Methods*, 6th edition. Hoboken, NJ: John Wiley & Sons, 2013.

Chudley, R., &, Greeno, R. — *Building Construction Handbook 11 edition, Routledge, 2016.*

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United Nations Framework Convention on Climate Change (UNFCCC). (2015). Paris Agreement. Retrieved from https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement

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2B: BUILDING DRAWING AND DESIGN
MODULE 3: MANAGEMENT AND DESIGN

GENERAL OBJECTIVES

On completion of this Module, students should:

1. *develop the ability to synthesise designs using new, emerging and greening technologies in construction management; and,*

2. *demonstrate proficiency in the preparation of sketches and drawings of building designs using CAD.*

SPECIFIC OBJECTIVES	CONTENT
Students should be able to:	
1. *examine the basic principles of construction management;*	*Construction Management Principles* (a) *Management techniques relating to:* (i) *production planning;* (ii) *cost control of projects; and,* (iii) *principles of planning repetitive and non-repetitive construction work.* (b) *Planning techniques:* (i) *bar charts;* (ii) *network analysis;* (iii) *line of balance; and,* (iv) *work study.* (c) *Plant decision making:* (i) *plant selection;* (ii) *plant acquisition (buying, leasing, indirect or direct ownership);* (iii) *developing and classifying objectives;*

SPECIFIC OBJECTIVES	CONTENT
Students should be able to:	
	(iv) *establishing alternatives choices;* (v) *evaluating the outcome of each alternative; and,* (vi) *choosing the best alternative.*
2. *discuss the key stages involved in the construction management process;*	*Construction Management Process* *Project life cycle:* (a) *Conception and initiation;* (b) *Definition/planning;* (c) *Launch/execution/construction phase/waste management;* (d) *Monitoring; and,* (e) *Close.*
3. *discuss the stages in the design process;*	*The Design Process* (a) *Recognition of need* (b) *Definition of problem* (c) *Synthesis* (d) *Analysis and optimisation* (e) *Evaluation* (f) *Presentation*
4. *explain the principles of design;*	*The Principles of Design* (a) *Elements:* (i) *material selection;*

SPECIFIC OBJECTIVES	CONTENT
Students should be able to:	
	(ii) *materials specification;* (iii) *manufacturing processes; and,* (iv) *size and shape.* (b) *Aesthetics* (c) *Ergonomics* (d) *Cost*
5. *create designs using new, emerging and greening technologies in construction management;*	(a) *New Emerging and Green construction technologies:* (i) *green construction management;* (ii) *technologies used in green construction (Application); and,* (iii) *importance and benefits.* (b) *New Emerging and Green construction Principles:* (i) *methods of Greening construction; (such as renewable energy, recycled grey water, increase natural lighting/ventilation, wind turbines, heat pumps);* (ii) *Green belt;* (iii) *environmental protection;* (iv) *Building Information Modeling (BIM);* (v) *climate resilient infrastructure;*

SPECIFIC OBJECTIVES	CONTENT
Students should be able to:	
	(vi) *benefits and limitations associated with Greening technologies; and,* (vii) *Sick Building Syndrome (SBS) and its management.*
6. *prepare sketches of external and internal design features of buildings using Computer-Aided Design (CAD);* and,	*Design Features of Buildings* (a) *External wall finishes:* (i) *trowel plastering;* (ii) *tile (ceramic, marble, clay, coral);* (iii) *cladding (metal, photovoltaic panels); and,* (iv) *paint.* (b) *Internal wall finishes:* (i) *paint;* (ii) *cladding; and,* (iii) *tiles (ceramic, marble, porcelain).* (c) *Floor finishes:* (i) *tiles (ceramic, marble, clay, porcelain, vinyl);* (ii) *hard wood (teak, mahogany, green heart); and,* (iii) *terrazzo.* (d) *Doors and windows (internal and external):* (i) *wooden (teak, mahogany, green heart);* (ii) *glass;*

SPECIFIC OBJECTIVES	CONTENT
Students should be able to:	(iii) *metal (steel, zinc, aluminium); and,* (iv) *polyvinyl chloride.* (e) *Cupboard:* (i) *wooden, for example, teak, mahogany, green heart, plywood, Medium Density Fibre Board (MDF), pine; and,* (ii) *concrete (block work).* (f) *Fixtures and fittings:* (i) *bathroom, for example, face basin, water closet, shower enclosure, shower taps, faucet;* (ii) *kitchen (kitchen sinks, faucet); and,* (iii) *smart fixtures and fittings.* (g) *Electrical Fittings:* (i) *lighting fixtures;* (ii) *electrical panel and power outlets;* (iii) *switches;* (iv) *auxiliary outlets, for example, television and networking cable; and,* (v) *smart electrical fixtures and fittings.*

SPECIFIC OBJECTIVES	CONTENT
Students should be able to:	
	(h) *Counter top finishes:* (i) *ceramics;* (ii) *porcelain;* (iii) *hard wood;* (iv) *synthetic surfaces;* (v) *granite; and,* (vi) *quartz.*
	(i) *Landscaping:* (i) *lawn, flower bed;* (ii) *driveway;* (iii) *walkway; and,* (iv) *rock garden.*
7. *produce designs and* working *drawings of buildings using Computer-Aided Design (CAD).*	*Building Design* (a) *Production of a full set of working drawings for a two-storey building.* (b) *Rendering and finishes.*

Suggested Teaching and Learning Activities

To facilitate students' attainment of the objectives of the Syllabus, teachers are advised to engage students in the teaching and learning activities below. These activities are designed to support a learner-centred, collaborative approach, and incorporate appropriate ICT tools where necessary while catering to students with various learning styles.

1. *Teachers are encouraged to utilise a blended classroom approach of instruction using online collaborative tools. Have students research and make presentations on topics contained in the Module. Have students watch educational videos relating to tests done on construction materials.*

Suggested Teaching and Learning Activities (cont'd)

2. *Have students conduct research and present on the basic principles of construction management.*

3. *Invite experts to conduct guest lectures to address students on the principles and elements of the design process. Students will then be required to journal on the lessons learnt from the lecture.*

4. *Have students organise in small groups to study the design features in the school and/or community and to solve a design problem related to a new and emerging technology. Have students deliver presentations and justify their designs.*

5. *Have students compare and contrast buildings with different design features (for example, the use of natural lighting versus the use artificial lighting and the use of solar energy as a power source versus fossil fuel).*

6. *Have students use case studies to justify the use of materials used to construct buildings.*

7. *Have students brainstorm then present the benefits and challenges for the use and application of the various new, emerging and greening technologies locally, regionally and internationally.*

8. *Discuss with students how buildings could be modified to include new, emerging and greening technologies.*

9. *Teachers are encouraged to coordinate Webinars/smart classroom on sustainable building designs and processes.*

10. *Have students produce sketches of internal and external building design features.*

11. *Have students construct physical models and produce Computer-Aided Design (CAD) simulations of buildings.*

12. *Teachers are encouraged to collaborate utilising the flat classroom to facilitate lessons in building management and design processes.*

RESOURCES

Chudley, R., and, Greeno, R.	*Construction Technology, 4th edition. Essex: Pearson Prentice Hall, 2005.*
Kovac, K., Chudley, R., and, Greeno, R.	*Building Construction Handbook, 13th edition. London: Routledge, 2024.*
Netscher, P.	*Construction Management: From Project Concept to Completion.*

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United Nations Framework Convention on Climate Change (UNFCCC). (2015). Paris Agreement. Retrieved from https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement

World Green Building Council. (2020). Advancing Net Zero: Carbon. Retrieved from https://www.worldgbc.org/advancing-net-zero

♦ OUTLINE OF ASSESSMENT

Each Unit of the syllabus will be independently assessed and graded separately. Candidates are expected to submit their responses to Paper 02 using the Computer-Aided Design (CAD) software.

EXTERNAL ASSESSMENT ***(60%)***

Written Papers

Paper 01
(1 hour 30 Minutes)

Unit 1 *30%*

This paper will consist of 45 multiple-choice items, 15 items based on each of the three Modules in the Unit. All items are compulsory. To accommodate the Option of either Module 3A or 3B, there will be two papers. Both papers will consist of 15 items from Modules 1 and 2 each and 15 items from either Module 3A or 3B.

(1 hour 30 Minutes) ***Unit 2***

Option A and Option B
The paper tests options A and B separately and consists of 45 multiple choice items, 15 items based on each of the three Modules in the Unit.

Paper 02
(2 hours 30 Minutes)

Unit 1 *30%*

Modules 1 and 2 are common to both options.

Option A - Mechanical
Three extended response compulsory questions arranged in three Sections A, B and C.

Section A tests Module 1; Section B tests Module 2; Section C tests Module 3.

Option B - Building
Three extended response compulsory questions arranged in three Sections A, B and C.

Section A tests Module 1; Section B tests Module 2; Section C tests Module 3.

Candidates will be required to answer All questions from Sections A, B and C.

Unit 2

Option A and Option B.

For each Option: Three extended response questions arranged in three Sections: A, B and C.

In both Options, Sections A, B and C each comprises one question. Section A tests Module 1; Section B tests Module 2; and Section C tests Module 3.

Candidates will be required to answer ALL questions from each Section.

SCHOOL-BASED ASSESSMENT *(40%)*

Paper 03

The SBA for Unit 1 is derived from the composite marks of the entries in the School-Based Assessment portfolio and which may include related CVQ Units of Competency aligned to the content in the syllabus. Where applicable the candidates who successfully complete selected Units in the CVQ* Regional Occupational Standards will be awarded a Statement of Competence. Students are expected to produce electronic portfolios where ALL entries are digitised.*

The SBA for Unit 2 is derived from the composite marks of the entries in the School-Based Assessment portfolio and which may include related CVQ Units of Competency aligned to the content in the syllabus. Where applicable the candidates who successfully complete selected Units in the CVQ* Regional Occupational Standards will be awarded a Statement of Competence. Students are expected to produce electronic portfolios where ALL entries are digitised.*

MODERATION OF SCHOOL-BASED ASSESSMENT

*Each year a School-Based Assessment Record Sheet will be sent to schools submitting candidates for the examination. All School-Based Assessment Record Sheets, sample assignments and records of units from the Regional Occupational Standards (ROS) that are completed, are to be submitted to the Local Registrar in time to reach **CXC®** by 31 May of the year of the examination. A sample of assignments will be requested by **CXC®** for moderation purposes.*

*These assignments will be assessed by **CXC®** Examiners to inform the moderation of scores submitted by the given teacher. Teachers' marks may be adjusted as a result of moderation. An Examiner's feedback report will be sent to each teacher.*

*Copies of students' assignments that are not included in the sample submitted to **CXC®** must be retained by the school until three months after the publication by **CXC®** of the examination results.*

Collaboration during the conceptualisation phase of the project (brainstorming of ideas) is encouraged.

ASSESSMENT DETAILS

Each Unit will be assessed as follows:

External Assessment by Written Papers – (60 per cent of Total Assessment)

Paper 01 (1 ½ hours – 30 per cent of Total Assessment)

1. Composition of the Paper

Unit 1

This paper consists of 45 multiple-choice items on all Modules as follows:

To accommodate the option between 3A and 3B, there will be two papers. Each paper will have 15 similar items each from Module 1 and Module 2 and 15 items from either Module 3A (Engineering Drawing) or 3B (Building Drawing). All questions are compulsory.

Unit 2

This paper consists of 45 multiple-choice items on all Modules as follows:

Option A (Mechanical Engineering) and Option B (Building Drawing) will each consist of 45 multiple-choice items; 15 items from each Module. All questions are compulsory.

2. Mark Allocation

This paper is worth 45 marks and contributes 30 per cent towards the final assessment. Each Module is worth 15 marks and contributes 10 per cent towards the final assessment.

3. Use of Calculators

Candidates may use silent, non-programmable calculators.

Paper 02 (2 ½ hours – 30 per cent of Total Assessment)

1. Composition of Paper

Unit 1

This paper consists of three questions in three sections, A, B and C. Each section contains one question.

- *Section A tests Module 1;*
- *Section B tests Module 2; and,*
- *Section C tests Module 3 Option A or Module 3 Option B.*

The candidate is required to answer ALL questions from Section A, Module 1 and Section B Module 2 and ALL questions from Section C (Module 3A or Module 3B).

Unit 2

For each option in the Unit, Paper 02 is divided into three sections, A, B and C, each representing one of the three Modules. Each section contains one question. The candidate is required to answer ALL questions from each of the three sections.

All questions are equally weighted and may require knowledge of more than one topic in the Module from which they are taken.

2. Mark Allocation

This paper is worth 90 marks and contributes 30 per cent towards the final assessment. Each Module is worth 30 marks and contributes approximately 10 per cent towards the final assessment. Each question is worth 30 marks.

3. Award of Marks

Full marks will be awarded for correct answers supported by relevant working or demonstration of the process.

*No marks will be awarded to a correct answer which is unsupported by any details of the method used (for example, calculations, construction or line-work). Candidates are therefore advised to show **all** their working.*

4. Use of Calculators

Candidates may use silent, non-programmable calculators.

SCHOOL-BASED ASSESSMENT (40 per cent of Total Assessment)

School-Based Assessment is an integral part of student assessment in the course covered by this syllabus. It is intended to assist students in acquiring certain knowledge, skills and attitudes that are associated with the subject. The activities for the School-Based Assessment are linked to the syllabus and should form part of the learning activities to enable the student to achieve the objectives of the syllabus.

During the course of study for the subject, students obtain marks for the competence they develop and demonstrate in undertaking their School-Based Assessment assignments. These marks contribute to the final marks and grades that are awarded to students for their performance in the examination.

The guidelines provided in this syllabus for selecting appropriate tasks are intended to assist teachers and students in selecting assignments that are valid for the purpose of School-Based Assessment. The guidelines provided for the assessment of the assignments are intended to assist teachers in awarding marks that are reliable estimates of the achievement of students in the School-Based Assessment component of the course. In order to ensure that the scores awarded by teachers are in line with the Caribbean Examinations Council's standards, the Council undertakes the moderation of a sample of the School-Based Assessment assignments marked by each teacher.

School-Based Assessment provides an opportunity to individualise a part of the curriculum to meet the needs of students. It facilitates feedback to the student at various stages of the experience. This helps to build the self-confidence of students as they proceed with their studies. Schools-Based Assessment also facilitates the development of the critical skills and abilities emphasised by this ***CAPE®*** *subject and enhances the validity of the examination on which candidate performance is reported. School-Based Assessment, therefore, makes a significant and unique contribution to both the development of relevant skills and the testing and rewarding of students for the development of those skills.*

The Caribbean Examinations Council seeks to ensure that the School-Based Assessment scores are valid and reliable estimates of accomplishment. The guidelines provided in this syllabus are intended to assist in doing so.

The School-Based Assessment will consist of a Portfolio for each Unit consisting of assignments taken from the Module(s) outlined in the syllabus.

INTEGRATION OF CVQ UNITS FOR THE SBA*

The list presented below has been mapped to the content in the syllabus. Teachers are encouraged to use this information as they develop activities and projects for the School-Based Assessment Component of the course:

Unit 1 – Building and Mechanical Engineering Drawing

Module 3A – Engineering Drawing
Qualification – CCMEM20702 Mechanical Maintenance

1. *MEMCOR0121A Classify engineering materials;*

2. *MEMCOR0141A Follow principles of occupational health and safety (OH&S) in work environment;*

3. *MEMCOR0091A Draw and interpret sketches and simple drawings;*
4. *MEMCOR0012A Plan a complete activity;*
5. *MEMCOR0161A Plan to undertake a routine task;*
6. *MEMCOR0171A Use graduated measuring devices;*
7. *MEMFAB0141A Develop geometric shapes;*
8. *MEMCOR0122A Write technical reports (basic);*
9. *MEMCOR0022A Perform related computations;*
10. *MEMCOR0042A Interpret standard specifications and manuals; and,*
11. *MEMCOR0052A Operate in an autonomous team environment.*

Module 3B – Building Drawing

Qualification – CCBCG20102 General Construction

1. *BCGCOR0001A Carry out interactive workplace communication;*
2. *BCGCOR0011A Carry out OH&S requirements;*
3. *BCGCOR0021A Plan and organise work;*
4. *BCGCOR0031A Draw and interpret simple drawings; and,*
5. *BCGCOR0041A Carry out measurements and calculations.*

Unit 2 – Building and Mechanical Engineering Drawing

Option A – Mechanical engineering Drawing and Design

Qualification – CCMEM20702 Mechanical Maintenance

1. *MEMCOR0012A Plan a complete activity;*
2. *MEMCOR0161A Plan to undertake a routine task;*
3. *MEMCOR0171A Use graduated measuring devices;*
4. *MEMFAB0141A Develop geometric shapes;*
5. *MEMCOR0122A Write technical reports (basic);*
6. *MEMCOR0022A Perform related computations;*

7. *MEMCOR0042A Interpret standard specifications and manuals;*
8. *MEMCOR0052A Operate in an autonomous team environment;*
9. *MEMCOR0022A Perform related computations; and,*
10. *MEMCOR0042A Interpret standard specifications and manuals.*

Option B – Building Drawing and Design

Qualification – CCBCG20102 General Construction

1. *BCGCOR0001A Carry out interactive workplace communication;*
2. *BCGCOR0011A Carry out OH&S requirements;*
3. *BCGCOR0021A Plan and organize work;*
4. *BCGCOR0031A Draw and interpret simple drawings;*
5. *BCGCOR0041A Carry out measurements and calculations;*
6. *BCGBCDBCD3A Prepare drawings, specifications and schedules using Computer-Aided Design (CAD) Systems;*
7. *BCGBCD0063A Produce working drawings for residential building;*
8. *BCGBCD0083A Apply mathematics to construction applications;*
9. *BCGBCD0093A Demonstrate knowledge of the science of materials and its Applications;*
10. *BCGBCD0113A Apply construction technology and services;*
11. *BCGBCD00123 Apply knowledge of building designing, detailing Specifications;*
12. *BCGBCD0163A Apply knowledge of planning the physical environment;*
13. *BCGBCD0173A Demonstrate knowledge of resource management;*
14. *BCGBCD0183A Develop civil engineering drawings;*
15. *BCGBCD0193A Apply knowledge of civil engineering constructions; and,*
16. *BCMBSV0014A Apply building codes and standards to residential building.*

UNIT 1

Paper 03 – Electronic Portfolio (40 per cent of the Total Assessment)

Composition

The Electronic Portfolio must consist of six assignments. Two assignments must be set on each Module. ***All assignments from each Module must be Computer-Aided Design (CAD)-based.*** *A complete record of freehand sketches and final drawing solutions must be submitted in the Electronic Portfolio. The assignments in each Electronic Portfolio will be assessed by the teacher and reassessed by a moderator appointed by* ***CXC®****.*

Mark Allocation

The mark recorded for each Module will be the average of the TWO Module assignments. ***The assignments for each Module is compulsory and failure to submit any of the assignments will result in no marks being awarded.*** *Each assignment is worth 20 marks and is set and assessed by the teacher, using the School-Based Assessment Assignments, Criteria and Mark Schemes provided on pages 75-79 of the syllabus.*

Assignments

Each candidate is required to produce a Drawing Portfolio consisting of six original drawings. Examples of appropriate sources and topics on which these assignments may be based are given below.

For ***EACH*** *assignment the student will submit a completed drawing or set of drawings on an appropriate electronic template with border lines and title block.*

UNIT 1

Candidates pursuing Option 3A (Engineering Drawing) will complete the following SBA Assignments *using the Computer-Aided Design (CAD) software and incorporate sustainable design/energy features in Assignment 6*:

Assignment 1

Candidates will be expected to produce *ONE* drawing based on Specific Objective *5* of Module 1.

Assignment 2

Candidates will be expected to produce ONE drawing based on Specific Objective *6* of Module 1.

Assignment 3

Candidates will be expected to produce ONE drawing based on Specific Objectives 2 to *4* of Module 2.

Assignment 4

Candidates will be expected to produce ONE drawing based on Specific Objective *5* of Module 2.

Assignment 5

Candidates will be expected to produce *ONE* drawing based on Specific Objectives 1, 2 and 3 of Module 3A.

Assignment 6

Candidates will be expected to produce *a set of assembly* drawings *including orthographic projections, at least TWO sectional elevations, ONE pictorial drawing, a parts list and balloon referencing, based* on Specific Objectives 4, 5 *and 6* of Module 3A.

Candidates pursuing Option 3B (Building Drawing) will complete the following SBA Assignments *using the Computer-Aided Design (CAD) software and incorporate sustainable design/energy features in Assignment 6*:

Assignment 1

Candidates will be expected to produce *ONE* drawing based on Specific Objectives *5* of Module 1.

Assignment 2

Candidates will be expected to produce ONE drawing based on Specific Objective *6* of Module 1.

Assignment 3

Candidates will be expected to produce ONE drawing based on Specific Objectives 2 to *4* of Module 2.

Assignment 4

Candidates will be expected to produce ONE drawing based on Specific Objective *5* of Module 2.

Assignment 5

Candidates will be expected to produce *ONE* drawing based on Specific Objective 1 of Module 3B.

Assignment 6

Candidates will be expected to produce *a set of* drawings *including floor plans, at least two sectional elevations, roof plan, site plan, at least two elevations, foundation plan, plumbing and electrical details (sectional roof, slab, stairs, wall stiffener and drainage/sewage/waste)* based on Specific Objectives 2 *and 3* of Module 3B.

Mark Scheme for Assignments 1, 2, 3, 4 and 5

The student will upload:

1. a completed drawing on an appropriate template.

Teachers should allocate marks as shown in the table below.

CRITERIA	MARKS	TOTAL MARKS
1. ***Use of commands to produce*** *lines and curves to form components (showing construction line where appropriate).* *- More than 90% accuracy* *- More than 80% accuracy* *- More than 70% accuracy* *- More than 60% accuracy*	 *4* *3* *2* *1*	***4***
2. Use of line types, line weight, centre lines dimensions as needed (Balloon referencing and parts listing, hatching lines). *- More than 90% accuracy* *- More than 85% accuracy* *- More than 80% accuracy* *- More than 70% accuracy* *- More than 60% accuracy*	 *5* *4* *3* *2* *1*	***5***
3. Accuracy of components drawn from given objects, sketches or drawings. *- More than 90% accuracy* *- More than 85% accuracy* *- More than 80% accuracy* *- More than 70% accuracy* *- More than 60% accuracy*	 *5* *4* *3* *2* *1*	***5***
4. Line work *- Presentation*	 *2*	***2***
5. Completion of drawings *- Title blocks completed* *- Border lines completed*	 *1* *1*	***2***
TOTAL		***18***

Mark Scheme for Assignment 6

The student will upload:

1. a completed drawing on an appropriate template.

Teachers should allocate marks as shown in the table below.

CRITERIA	MARKS	TOTAL MARKS
*1. **Use of commands to produce** lines and curves to form a set of drawings/components (showing construction line where appropriate).* *- More than 95% accuracy* *- More than 90% accuracy* *- More than 85% accuracy* *- More than 80% accuracy* *- More than 70% accuracy* *- Less than 70% accuracy*	 *6* *5* *4* *3* *2* *1*	***6***
2. Use of line types, line weight, centre lines dimensions as needed to complete a set of drawings (Balloon referencing and parts listing, hatching lines). *- More than 95% accuracy* *- More than 90% accuracy* *- More than 85% accuracy* *- More than 80% accuracy* *- More than 70% accuracy* *- Less than 70% accuracy*	 *10* *8* *6* *4* *2* *1*	***10***
3. Accuracy of components drawn from given objects, sketches or drawings. *- More than 95% accuracy* *- More than 90% accuracy* *- More than 85% accuracy* *- More than 80% accuracy* *- More than 70% accuracy* *- Less than 70% accuracy*	 *6* *5* *4* *3* *2* *1*	***6***
4. Line work *- Presentation*	 *2*	***2***
5. Completion of drawings *- Title blocks completed* *- Border lines completed*	 *1* *1*	***2***
6. Inclusion of sustainable design/energy features *- Placement and Justification with more than 90% accuracy* *- Placement and Justification with more than 85% accuracy* *- Placement and Justification with more than 80% accuracy* *- Placement and Justification with more than 70% accuracy*	 *4* *3* *2* *1*	***4***
TOTAL		**30**

General

1. *Teachers should inform candidates of the assessment criteria.*

2. *Teachers should guide the candidates in choosing appropriate assignments that relate to the candidates' interest and specific objectives identified.*

3. *Teachers and candidates should agree to a schedule of the dates for submitting assignments.*

4. *The teacher should offer guidance in the process and the preparation of the portfolio.*

All* Design *Electronic* Portfolio*s will be assessed by the teacher and reassessed by a moderator appointed by CXC®.

Management of Electronic Portfolio

Teachers should encourage students to start the first assignment during the first term.

UNIT 2

Paper 03 – Design Portfolio

Composition

The Design Portfolio must consist of three phases leading to the final design solution, namely:

(a) *Phase 1 – Conceptualisation of the project;*
(b) *Phase 2 – Design of project; and,*
(c) *Phase 3 – Work programme (methodology, resources, schedule).*

Students will be assessed on completed assignments at each phase. ***The Design Electronic Portfolio must be CAD-based, with evidence of the acquisition of knowledge and skills gained at each phase****. Students are encouraged to work collaboratively during phase 1. A* complete record of the proposal, pictorial and working drawings, *CAD generated* sketches, specifications, *calculations, authenticated evidence of work done during the presentation phase and final design solution should be kept in the Design* ***Electronic*** *Portfolio. In addition, students should incorporate sustainable design/energy features. All Design* ***Electronic*** *Portfolios will be assessed by the teacher and reassessed by a moderator appointed by* ***CXC®****.*

Each student must prepare a technical report on the project and make a presentation of his/her final design solution in class. Teachers are encouraged to use experts in the fields of mechanical engineering and architectural design to provide feedback on candidates' work.

Mark Allocation

There is one assignment in the Design Portfolio which is worth 60 marks. These marks will be awarded based on the criteria listed below (see pages 75-79) for detailed breakdown of Assessment Criteria).

Assessment Criteria		*Marks*
(i)	*Development of Project*	*32*
	• *Phase 1 – Conceptualisation of the Project* *(08)* • *Phase 2 - Design of Project* *(16)* • *Phase 3 – Work programme (methodology, resources schedule)* *(08)*	
(ii)	*The Project Report*	*16*
(iii)	*Contents of Portfolio*	*04*
(iv)	*The Interactive Presentation*	*08*

SCHOOL-BASED ASSESSMENT CRITERIA AND MARK SCHEMES

Project, Design Portfolio and Interactive Presentation

Candidates will be awarded a total of six marks for communicating information in a logical way using correct grammar.

The assessment of the Design Portfolio must be done by the teacher. The Assessment Criteria provided below are intended to assist teachers in awarding marks that are reliable assessments of the achievement of students on the design project they select. These assessments should be submitted to ***CXC®****.*

	Assessment Criteria	*Range of Marks*	*Total Marks*
1	***Development of Project***		***32***
	Phase 1 – Conceptualisation of Project	***(8)***	
	In this phase, students are expected to work collaboratively while seeking guidance of their teachers and engage in research that will inform the conceptualisation of the Project.		
	- ***Good***		
	• *Demonstrated understanding of sustainable design/energy concept(s)*	*3*	
	• *Demonstrated an understanding and good insight of concept(s)*	*2*	
	• *Demonstrated keen interest for the task*	*1*	
	• *Gathered relevant information (90%) from appropriate sources*	*1*	
	• *Required minimal supervision to complete complex and routine tasks*	*1*	
	- ***Satisfactory***		
	• *Demonstrated a satisfactory understanding of the concept(s)*	*2*	
	• *Demonstrated interest in the task*	*1*	
	• *Gathered relevant information (70%) from appropriate sources*	*1*	
	• *Required some supervision to complete complex tasks but not the routine tasks*	*1*	
	- ***Limited***		
	• *Demonstrated a limited understanding of the concept(s)*	*1*	
	• *Unable to complete routine tasks without supervision*	*1*	

	Assessment Criteria	Range of Marks	Total Marks
	Phase 2 – Design of Project *In this practical phase, students are expected to work closely with their teachers to complete a) to f) for their Projects.* *The design must include:* *(a) sketches of preliminary and final design solutions* *(b) detailed working drawings* *(c) assembly drawings* *(d) application of theories explored in Phase 1* *(e) sustainable energy features* *(f) the specifications of the component(s) in the Project* - ***Good:*** *Sketches and drawings for more than THREE different design solutions presented. Strong link between the theories explored in Phase 1 and details in sketches and drawings of the chosen design. Good rationale for the chosen specifications (>90%).* - ***Satisfactory:*** *Sketches and drawings for THREE different design solutions presented. Satisfactory link between the theories explored in Phase 1 and details in the sketches and drawings of the chosen design. Satisfactory rationale for the chosen specifications (>75%).* - ***Limited:*** *Sketches and drawings for less than THREE different design solutions presented. A moderate link between the theories explored in Phase 1 and details in the sketches and drawings of the chosen design. Fair rationale for the chosen specifications (<75%).*	*16* *10* *4*	***16***

	Assessment Criteria	Range of Marks	Total Marks
	Phase 3 – Work Programme		***8***
	This report must include: *(a) statement of approach or methodology* *(b) justification/rationale for sustainable design/energy features chosen* *(c) resources, including software, equipment and literature used* *(d) scheduling of tasks for each Phase* - ***Good:*** *Used appropriate methodology and resources. Most tasks (>90%) completed and schedule indicates an efficient use of time.* - ***Satisfactory:*** *Used appropriate methodology. Many tasks (>75%) completed and suitable resources were used. Schedule indicates a satisfactory use of time.* - ***Fair:*** *Inappropriate use of methodology and/or most resources. There were many incomplete tasks and/or the schedule was loosely organised (<75%).*	*8* *5* *2*	

	Assessment Criteria	Range of Marks	Total Marks
2	***The Project Report***		***16***
	(a) Project proposal (statement of purpose or definition of problem).	***2***	
	- *Concise, aligned with the design problem*	*2*	
	- *Loose or ambiguous alignment with the design problem*	*1*	
	(b) Statement of project scope and specifications.	***2***	
	- *Statement is relevant to project theme/title, specifications unambiguous*	*2*	
	- *Statement is generally relevant to project theme/title some ambiguity in specifications*	*1*	
	(c) Statement of sustainable design/ energy features.	***2***	
	- *Design/Energy features are relevant to the project*	*2*	
	- *Design/Energy features partially aligned to the project*	*1*	
	(d) Constraints and limitations.	***2***	
	- *Satisfactory insight in the identification of problem-solving strategies*	*2*	
	- *Limited insight in the identification of problem-solving strategies*	*1*	
	(e) Final design of project (freehand sketches, detailed working drawing, assembly drawing, specifications).	***4***	
	- *Satisfactory match of products with specifications outlined in the project scope*	*4*	
	- *Limited match of products with specifications outlined in the project scope*	*2*	
	(f) Communication of information in a logical way.	***4***	
	- *communicates information in a logical way using correct grammar and appropriate terminology of the field MOST of the time*	*4*	
	- *communicates information in a logical way using correct grammar and appropriate terminology of the field SOME of the time*	*3*	
	- *communicates information in a logical way RARELY using correct grammar and appropriate terminology of the field*	*1*	

	Assessment Criteria	Range of Marks	Total Marks
3	***Contents of Portfolio***		***4***
	- ***Good**: Contents were neatly organised, containing relevant materials for the task.*	*4*	
	- ***Satisfactory**: Contents were generally neat and organised and/or most of the materials were relevant for the task.*	*2*	
	- ***Limited:** Contents were loosely organised and/or contained many irrelevant materials for the task.*	*1*	
4	***The Interactive Presentation***		***8***
	- *Quality of presentation*	***5***	
	• *Logical sequence of ideas in presentation; student demonstrates full knowledge of the topic by answering questions with explanations and elaboration*	*5*	
	• *Explanation needed to follow the sequence of ideas in presentation; student demonstrates knowledge of most aspects of the topic and answered the rudimentary questions.*	*3*	
	• *Sequence of ideas erratic and difficult to follow; student was unable to answer many of the questions related to the topic*	*1*	
	- *Use of computer-aided material*	***2***	
	• *Generally relevant to concepts*	*2*	
	• *Moderately relevant to concepts*	*1*	
	- *Communication of Information (vocabulary, grammar)*	***1***	
	• *Presented ideas using appropriate terminology and generally correct grammar*	*1*	
Total			***60***

♦ REGULATIONS FOR PRIVATE CANDIDATES

Candidates who are registered privately will be required to sit Paper 01, Paper 02 and Paper 03. Detailed information on Papers 01, 02 and 03 is given on pages *62-63*.

♦ REGULATIONS FOR RESIT CANDIDATES

Resit candidates must complete Papers 01 and 02 of the examination for the year for which they re-register. Resit candidates may elect not to repeat the School-Based Assessment component, provided they rewrite the examination no later than two years following their first attempt.

A candidate who rewrites the examination in the same Unit within two years may opt to complete a School-Based Assessment for each Unit written or may opt to reuse the moderated SBA score earned in the previous sitting within the preceding two years. Candidates reusing SBA scores in this way must register as "Resit candidates" and provide the previous candidate number. Candidates are no longer required to earn a moderated score that is at least 50 per cent of the maximum possible score; any moderated score may be reused.

Resit candidates must be entered through a school, a recognised educational institution, or the Local Registrar's Office.

♦ ASSESSMENT GRID

The Assessment Grid for each Unit contains marks assigned to each paper and to each Module and the percentage contribution of each paper to total scores.

Unit 1

PAPERS	***MODULES***			***TOTAL (WEIGHTED)***	***(%)***
	Module 1	*Module 2*	*Module 3*		
External Assessment Paper 01	*15 (30)*	*15 (30)*	*15 (30)*	*45 (90)*	*(30)*
Paper 02	*30*	*30*	*30*	*90*	*(30)*
School-based Assessment Paper 031	*36 (40)*	*36 (40)*	*48 (40)*	*120*	*(40)*
Total (weighted)	*100*	*100*	*100*	*300*	*(100)*

Unit 2

PAPERS	MODULES			TOTAL (WEIGHTED)	(%)
	Module 1	Module 2	Module 3		
External Assessment Paper 01	15 (30)	15 (30)	15 (30)	45 (90)	(30)
Paper 02	30	30	30	90	(30)
School-based Assessment Paper 031	20 (40)	20 (40)	20 (40)	60 (120)	(40)
Total (weighted)	100	100	100	300	(100)

♦ *ADDITIONAL* RESOURCES

British Standards Institutions, *Engineering Drawing Practice for Schools and Colleges*, London: British Standards Institution, 1986.

BS 4500A, *Selected ISO Fits – Hole Basis.*
BS 4500B, *Selected ISO Fits – Shaft Basis.*

Aubin, P. F.	*Mastering AutoCAD Architecture, 7th Edition.*
Aubin, P. F., Mackey, D. P. and Brumm, H.	*Revit Essentials for Architecture: 2021 and beyond (Aubin Academy) Paperback – August 26, 2020.*
Blokdyk, G.	*Chief Architect A Complete Guide – 2019 Edition.*
Brown, W. C.	*Drafting for Industry*. Illinois: Goodhart Wilcox, 1994.
Leach, J. A., Lockhart, S., and, Tilleson, E.	*AutoCAD 2025 Instructor Perfect Paperback* *(Please note that the software is upgraded yearly, and it is recommended that we use the latest edition).*
Omura, G., and, Benton, B. C.	*Mastering AutoCAD 2025 and AutoCAD LT, 2025.* *(Please note that the software is upgraded yearly, and it is recommended that we use the latest edition).*
Simmons, C., and, Maguire, D.	*A Manual of Engineering Drawing.* London: Hodder and Stoughton, 1995.
Stine, D. J.	*Design Integration Using Autodesk Revit, 2025, Paperback.*

♦ GLOSSARY OF TERMS

WORD/TERM	DEFINITION/MEANING
account for	present reason for action or event
annotate	add a brief note to a label
apply	use knowledge of principles to solve problems
assess	present reasons for the importance of particular structures, relationships or process
calculate	arrive at the solution to a numerical problem
classify	divide into groups according to observable characteristics
comment	state opinion or view with supporting reasons
compare	state similarities and differences
comply	*act in accordance with/ follow rules, standards and expectations.*
construct	use a specific format to make and draw a graph, histogram, pie chart or other representation using data or material provided or drawn from practical investigations, build (for example, a model), draw scale diagram
deduce	make a logical connection between two or more pieces of information; use data to arrive at a conclusion
define	state concisely the meaning of a word or term
demonstrate	show; direct attention to...
describe	provide detailed factual information of the appearance or arrangement of a specific structure or a sequence of a specific process
determine	find the value of a physical quantity
design	plan and present with appropriate practical detail
develop	expand or elaborate an idea or argument with supporting reasons
diagram	simplified representation showing the relationship between components.
differentiate	state or explain briefly those differences between or among items which can be used to define the items or place them into separate categories.
discuss	present reasoned argument; consider points both for and against; explain the relative merits of a case

WORD/TERM	DEFINITION/MEANING
draw	make a line representation from specimens or apparatus which shows an accurate relation between the parts
estimate	make an approximate quantitative judgement
evaluate	weigh evidence and make judgements based on given criteria
explain	give reasons based on recall; account for
find	locate a feature or obtain as from a graph
formulate	devise a hypothesis
identify	name or point out specific components or features
illustrate	show clearly by using appropriate examples or diagrams, sketches
investigate	use simple systematic procedures to observe, record data and draw logical conclusions
label	add names to identify structures or parts indicated by pointers
list	itemise without detail
measure	take accurate quantitative readings using appropriate instruments
name	give only the name of
note	write down observations
observe	pay attention to details which characterise a specimen, reaction or change taking place; to examine and note scientifically
outline	Give basic steps only
plan	prepare to conduct an investigation
predict	use information provided to arrive at a likely conclusion or suggest a possible outcome
record	write an accurate description of the full range of observations made during a given procedure
relate	show connections between; explain how one set of facts or data depend on others or are determined by them
sketch	make a simple freehand diagram showing relevant proportions and any important details
state	provide factual information in concise terms outlining explanations

WORD/TERM	DEFINITION/MEANING
suggest	offer an explanation deduced from information provided or previous knowledge. (... a hypothesis; provide a generalisation which offers a likely explanation for a set of data or observations.)
test	to find out, following set procedures

♦ MINIMUM EQUIPMENT LIST

(For Every 15 Students)

EQUIPMENT/MATERIAL	DESCRIPTION/SPECIFICATION	QUANTITY
Drawing *Lab*	With proper lighting *Sufficient power outlets* *Multimedia Projector* *Electronic Sketchpads*	 *1* *15*
Computer Chairs		15
Computer	*System requirements for AutoCAD LT 2021 (Windows)* *Operating System:* *64-bit* *Processor:* *Basic: 2.5 – 2.9 GHz* *Recommended: 3+ GHz* *Memory:* *Basic 16 GB* *Recommended 24 GB* *Display Resolution:* *Conventional Displays:* *1920 x 1080 with True Colour* *High Resolution and 4K Displays:* *Resolutions up to 3840 x 2160* *supported on* *Windows 11, 64-bit systems (with capable display card)* *Display Card:* *Basic: 1 GB GPU with 29 GB/s* *Bandwidth and* *DirectX 11 compliant* *Disk Space:* *11 GB* *Pointing Device:* *MS-Mouse compliant* *.NET Framework:* *.NET Framework Version 5.4*	*15*
Monitor	15 or 17 inches (1024 x 768 VGA with true colour)	5
Software	AutoCAD *2021 2025* or later version *AutoCAD Architecture 2021 2025 or later version* Chief Architect *(X16) or latest* version Revit *2025 or later version* 3D Home or 3D Architect *latest version* SKETCHUP	1 copy
ISO Standard/BS 3888	Technical Drawing	1
ISO Standard/PP 7307	Graphical symbols for use in schools and colleges	1
ISO Standard/PP 7308	Engineering Drawing Practice for schools and colleges	1
ISO Standard TC-S9	Buildings and civil engineering works	1
ISO Standard ICS - 91	Construction Material and Building	1
International Building Code	Electrical code Plumbing code Structural code Wind code Earthquake code	1
Local Code		1

Students are expected to provide the following:

1. *laptops/tablets or sketchpads; and,*
2. external storage device (thumb drive) *1 TB*.

Western Zone Office

29 June 2026

CARIBBEAN EXAMINATIONS COUNCIL®

Caribbean Advanced Proficiency Examination®
CAPE®

Building and Mechanical Engineering Drawing

Specimen Papers and Mark Schemes/Keys

Specimen Papers, Mark Schemes and Keys:

OPTION A — MECHANICAL ENGINEERING DRAWING
Unit 1 Paper 01
Unit 1 Paper 02
Unit 1 Paper 032
Unit 2 Paper 01
Unit 2 Paper 02

OPTION B — BUILDING DRAWING
Unit 1 Paper 01
Unit 1 Paper 02
Unit 1 Paper 032
Unit 2 Paper 01
Unit 2 Paper 02

TEST CODE **02169010**

SPECIMEN 2026

CARIBBEAN EXAMINATIONS COUNCIL

CARIBBEAN ADVANCED PROFICIENCY EXAMINATION®

BUILDING AND MECHANICAL ENGINEERING DRAWING

OPTION B — BUILDING DRAWING

UNIT 1 —Paper 01

1 hour 30 minutes

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This test consists of 45 items. You will have 1 hour and 30 minutes to answer them.
2. In addition to this test booklet, you should have an answer sheet.
3. Do not be concerned that the answer sheet provides spaces for more answers than there are items in this test.
4. Each item in this test has four suggested answers lettered (A), (B), (C), (D). Read each item you are about to answer and decide which choice is best.
5. On your answer sheet, find the number which corresponds to your item and shade the space having the same letter as the answer you have chosen. Look at the sample item below.

   Sample Item

   In drawings, thin, short dashes represent

   (A) hidden details
   (B) adjacent parts
   (C) movable parts
   (D) irregular details

   Sample Answer

   The best answer to this item is "hidden details", so (A) has been shaded.
6. If you want to change your answer, erase it completely before you fill in your new choice.
7. When you are told to begin, turn the page and work as quickly and as carefully as you can. If you cannot answer an item, go on to the next one. You may return to that item later.
8. You may do any rough work in this booklet.
9. Figures are not necessarily drawn to scale.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

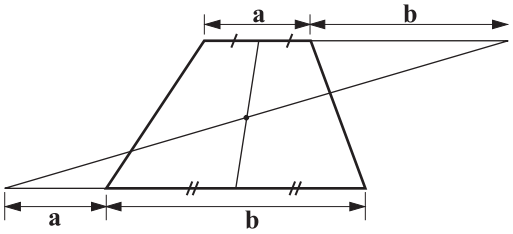
1. Which of the following geometric shapes is obtained by cutting a right cone at an angle to its base?

(A) Circle
(B) Ellipse
(C) Parabola
(D) Hyperbola

2. Which of the following engineering curves may be defined as the locus of a point which moves away from another fixed point at uniform linear velocity and uniform angular velocity?

(A) Involute
(B) Cycloid
(C) Epicycloid
(D) Archimedean spiral

Item **3** refers to the following diagram.



3. The diagram shows how to

(A) find the area of a quadrilateral
(B) determine the perimeter of a trapezium
(C) find the centre of gravity of a trapezium
(D) divide a trapezium into four parts of equal area

4. Which command works on two lines to create a bevelled edge?

(A) Fillet
(B) Extend
(C) Stretch
(D) Chamfer

5. The centroid coincides with the centre of mass or the centre of gravity only if the material of the body is

(A) solid
(B) irregular
(C) symmetrical
(D) homogenous

6. If an area possesses two lines of symmetry, its centroid lies at

(A) the end of each symmetry line

(B) the intersection of the lines of symmetry

(C) $\frac{1}{3}$ from point of the intersection

(D) $\frac{1}{2}$ from point of the intersection

7. The eccentricity of an ellipse is $\frac{3}{5}$. Into how many equal parts is the line joining the directrix to the focus divided when constructing the ellipse using the eccentricity method?

(A) 3
(B) 5
(C) 8
(D) 15

8. In orthographic projection, when a line passes through a plane, the point of intersection is

(A) a trace
(B) oblique projection
(C) first-angle projection
(D) third-angle projection

9. What shape is formed when a plane cuts a cone parallel to the axis?

(A) Circle
(B) Ellipse
(C) Parabola
(D) Hyperbola

10. Which of the following is NOT in the modify toolbar?

(A) Erase
(B) Array
(C) Draw
(D) Offset

11. Which of the following statements are true of first-angle projection?

I. The base represents the horizontal plane onto which is projected the plan.
II. The three sides represent the three vertical planes onto which the front elevation and the two end elevations are projected.
III. The end elevation is in the vertical plane to the plan.

(A) I and II only
(B) I and III only
(C) II and III only
(D) I, II and III

12. Which of the following definitions BEST describes an ellipse?

(A) Locus of a curve that moves around a cylindrical object
(B) Locus of a point on the periphery of a circle which rolls on a straight path
(C) Locus of a point moving such that the ratio of the distances from a fixed point and a fixed line remain constant
(D) Locus of a point moving such that a curve is generated on the periphery of a circle along the foci

13. The moment of inertia is minimum when the axis passes

(A) along the x-axis
(B) through the y-axis
(C) through the centre of the object
(D) through the centroid of the object

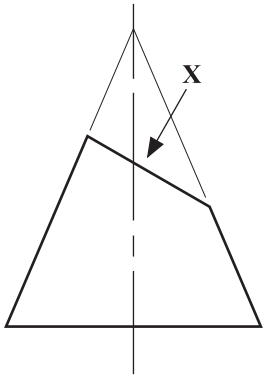
14. Which of the following is the unit for moment of inertia?

(A) m^3
(B) m^4
(C) m^2/sec
(D) m^3/sec

15. The MAIN purpose of using the absolute coordinate method in CAD is to

(A) draw freehand
(B) automate drawing processes
(C) define points using a fixed origin
(D) create objects without reference points

Item **16** refers to the following diagram of a truncated cone.



16. The view taken from the position of Arrow X is an

(A) oblique view
(B) isometric view
(C) auxiliary view
(D) orthographic view

17. A surface of two or more geometric shapes joined together is a

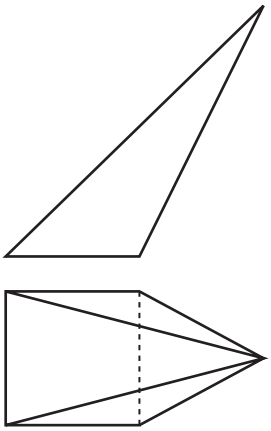
(A) ruled surface
(B) radial surface
(C) parallel surface
(D) composite surface

18. A right circular cone with a base diameter of 80 mm and a slant height of 120 mm is to be developed (unrolled) into a flat pattern.

What would be the sector angle of the resulting development?

(A) 120°
(B) 150°
(C) 180°
(D) 240°

Item **19** refers to the following views of an oblique square pyramid.



19. Which of the following is the MOST suitable method to use when constructing the development of the oblique square pyramid?

(A) Method of arcs
(B) Measuring sides
(C) Transition method
(D) Method of triangulation

20. The **primary** reason for using an auxiliary view is to

(A) locate centre marks
(B) eliminate hidden lines
(C) show cylinders as ellipses and spheres
(D) create a true projection plane from an incline plane

GO ON TO THE NEXT PAGE

21. In the geometric construction of a helix, a cylinder of 60 mm diameter has a helix drawn on its surface with a pitch of 40 mm. The circumference of the cylinder is unrolled into a straight line and set against the pitch height as a right-angled triangle.

What does the hypotenuse of this triangle represent?

(A) True length of one turn
(B) Lead angle of the helix
(C) Thread development
(D) Axis of cylinder

22. Which orthographic view is needed to produce an auxiliary elevation?

(A) End
(B) Plan
(C) Section
(D) Elevation

23. Which of the following pairs of drawing skills is necessary when drawing the development of a cylinder with an oblique top?

(A) Plan and section
(B) Plan and elevation
(C) Elevation and section
(D) Elevation and end elevation

24. A hexagonal pyramid that does NOT have its apex directly above the centre of its base is described as

(A) a regular pyramid
(B) a frustum pyramid
(C) an oblique pyramid
(D) a truncated pyramid

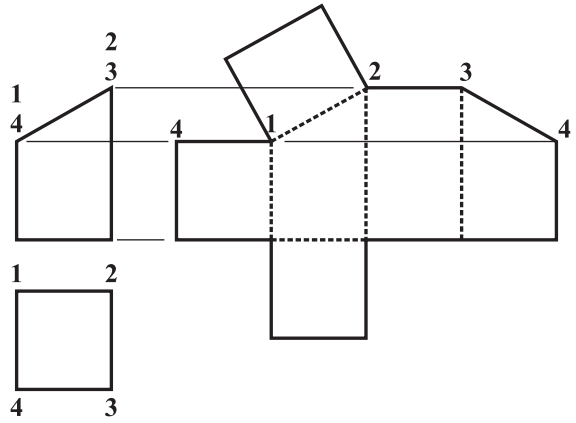
25. In isometric projection, the four-centre method is used to construct

(A) an ellipse
(B) a square
(C) a triangle
(D) a rectangle

26. In order to classify a pictorial drawing as an isometric projection, the isometric axes MUST be

(A) 30° apart
(B) 45° apart
(C) 60° apart
(D) 120° apart

Items **27** and **28** refer to the following diagram.



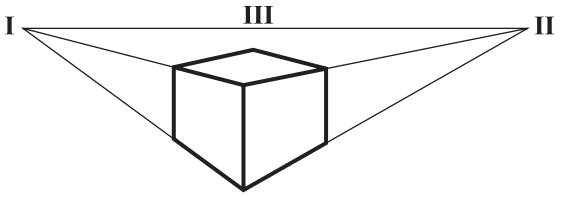
27. The development in the diagram shows a

(A) square prism with a square top
(B) pyramid with a rectangular top
(C) square prism with an oblique top
(D) hexagonal prism with a square top

28. What do the dotted lines in the development represent?

(A) Width
(B) Corners
(C) Cutting line
(D) Drawing line

Item **29** refers to the following pictorial diagram of a box.



29. What type of projection was used to draw the box?

(A) Oblique
(B) Isometric
(C) Perspective
(D) Planometric

30. The line of intersection is a curve when the two solids are a

(A) cube and a prism
(B) cone and a cylinder
(C) cube and a pyramid
(D) pyramid and a cuboid

31. A homeowner in a hot tropical climate is choosing a roof covering to minimize heat gain into the building.

Which properties of the roofing material would MOST likely contribute to reducing the cooling load?

(A) Low thermal mass and dark colour
(B) High thermal mass and dark colour
(C) High solar reflectance and low thermal emittance
(D) High solar reflectance and high thermal emittance

32. Which of the following is/are NOT a component of building structures?

(A) Rendering
(B) Columns
(C) Beams
(D) Roofs

33. The MOST commonly used type of foundation is the

(A) pad
(B) pile
(C) step
(D) strip

34. Each common rafter (including the tail) of a gable roof is 14′ long. How many 16′ pieces of lumber constructed 24″ on centres, will be needed to provide common rafters for a 30′ long building with no overhang?

(A) 28
(B) 30
(C) 32
(D) 42

35. A timber staircase has open treads (no risers) and shows noticeable springiness and lateral sway when in use, despite the treads being adequately sized for the span.

Which inadequacy in the construction feature MOST likely accounts for this?

(A) Absence of risers to provide rigidity
(B) Insufficient nosing on the tread edges
(C) Omission of a carriage piece beneath the treads
(D) Use of housed joints instead of wedged joints at the strings

36. Which of the following types of architectural drawings is used to illustrate detailed structural components?

(A) Pictorial
(B) Oblique
(C) Sectional
(D) Perspective

37. What is the MOST appropriate way of improving the bearing capacity of waterlogged soil?

(A) Adding vegetable matter to the soil
(B) Increasing the depth of the soil
(C) Compacting the soil
(D) Draining the soil

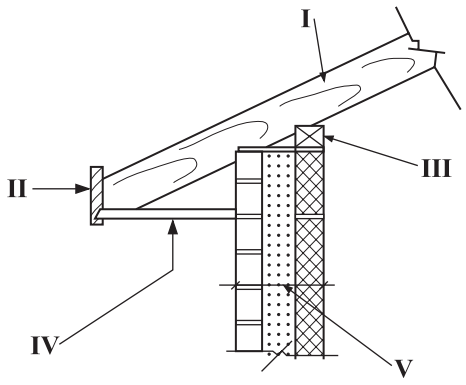
38. An overview of boundaries, proposed buildings, natural features and entrances is shown on a

(A) site plan
(B) floor plan
(C) front elevation
(D) pictorial drawing

39. If a sewer line is blocked, which of the following would give clear access for checking?

(A) Manhole
(B) Soakaway
(C) Main drain
(D) Septic tank

Items **40** and **41** refer to the following diagram with several labelled components.



40. The diagram shows

(A) a roof plan
(B) a roof detail
(C) an eave detail
(D) a column detail

41. The component labelled II indicates the

(A) eave
(B) rafter
(C) wall plate
(D) fascia board

42. Which of the following is NOT a function of a foundation?

(A) Aesthetics
(B) Load distribution
(C) Anchoring the building
(D) Transferring loads to the subsoil

43. The MAIN purpose of a legend on an electrical plan is to

(A) locate the site
(B) locate the pothead
(C) explain fixtures
(D) explain contours

44. A stair which extends from one level to another without turns or winders may be classified as a

(A) straight run
(B) quarter turn
(C) half turn
(D) spiral

45. A quarter turn stairway will make a turn of

(A) 45°
(B) 60°
(C) 90°
(D) 180°

END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.

C A R I B B E A N E X A M I N A T I O N S C O U N C I L

CARIBBEAN ADVANCED PROFICIENCY EXAMINATION

BUILDING AND MECHANICAL ENGINEERING DRAWING

OPTION B — BUILDING DRAWING

UNIT 1

SPECIMEN PAPER 2026

Item No.	Key	Specific Objective
1	B	1:1:3a
2	D	1:1:3a
3	C	1:1:2
4	D	1:1:1c
5	D	1:1:4
6	B	1:1:4
7	C	1:1:3a
8	A	1:1:6
9	D	1:1:3a
10	C	1:1:1c
11	B	1:1:6a
12	C	1:1:3a
13	D	1:1:5a
14	B	1:1:5a
15	C	1:1:1
16	C	1:2:2a
17	B	1:2:4b
18	A	1:2:4a
19	D	1:2:4a
20	D	1:2:2
21	A	1:2:5
22	B	1:2:2c
23	B	1:2:4a

Item No.	Key	Specific Objective
24	C	1:2:4a
25	A	1:2:1b
26	D	1:2:1a
27	C	1:2:4a
28	B	1:2:4a
29	C	1:2:1 a
30	B	1:2:3
31	D	1:3B:3
32	A	1:3B:3
33	D	1:3B:3
34	C	1:3B:3b
35	A	1:3B:3f
36	C	1:3B:2
37	D	1:3B:3
38	A	1:3B:3e
39	A	1:3B:3e
40	C	1:3B:2b
41	D	1:3B:2A
42	A	1:3B:4g
43	C	1:3B:1
44	A	1:3B:3
45	C	1:3B:3

CARIBBEAN EXAMINATIONS COUNCIL
BUILDING AND MECHANICAL ENGINEERING DRAWING
OPTION B – BUILDING DRAWING
UNIT 01– PAPER 02
TABLE OF SPECIFICATIONS
SPECIMEN

Module	Content	Item No.	Objectives	Profiles and Marks			Total
				Knowledge	Application	Drawing Skills	
1	Standard Geometrical Curves	**1(a) (i-iii)**	1.1.3(a) & (b)	3	3	4	10
	Orthographic Projection	**1(b)** (i) – (v)	1.1.6(a)	5	7	8	20
Subtotal				**8**	**10**	**12**	**30**
2	Pictorial Projections	**2(a)**	1.2.1(a)	3	3	4	10
	Intersection and interpenetration of solids such as spheres, cones, cylinders, pyramids and prisms.	**2(b) (i)-(v)**	1.2.3 1.2.4(a)	4	8	8	20
Subtotal				**7**	**11**	**12**	**30**

Module	Content	Item No.	Objectives	Profiles and Marks			Total
				Knowledge	Application	Drawing Skills	
3	Working and Assembly Drawings	3(a) (b) (c)	1.3B.1& 2(a) 1.3B.1 &2(c) 1.3B.1,2&3(a)	2 2	2 2 4	4 8	24
	Solutions to Engineering Problems	3(d)	1.3B.3(d) (i),(v)	2	4		6
Subtotal				**6**	**12**	**12**	**30**
Total				**21**	**33**	**36**	**90**

TEST CODE **02169020**

SPECIMEN 2026

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CARIBBEAN ADVANCED PROFICIENCY EXAMINATION®

BUILDING AND MECHANICAL ENGINEERING DRAWING

OPTION B — BUILDING DRAWING

UNIT 1 — Paper 02

2 hours 30 minutes

GENERAL INFORMATION

1. This paper consists of THREE questions. Answer ALL questions.
2. Silent, non-programmable calculators may be used for this examination.
3. For this examination, each candidate should have the following.

   A minimum of six sheets of 11" × 17" paper
   Personal computer with monitor, keyboard, mouse and printer
   Computer-aided drafting software

   NOTE: After completing EACH question, save your work electronically on the available storage device. At the conclusion of the examination, the invigilator will give you instructions for submitting the saved files for printing. All work MUST be printed for submission.

INSTRUCTIONS TO CANDIDATES

1. All dimensions given are in millimetres unless otherwise stated.
2. Where scales are not stated, the full size should be applied.
3. All geometrical construction lines MUST be visible on all drawings.
4. When first-angle or third-angle is not specified, the choice of projection is left to the candidate's discretion, in which case the type of projection used MUST be clearly stated.
5. The candidate should use his/her own judgement to supply any dimensions or other details not directly shown on the drawings.
6. The number of each question MUST be written next to the solution.
7. Each candidate MUST enter his/her school code and registration number in the appropriate space at the bottom of the drawing paper.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

SECTION A

MODULE 1 — GEOMETRY 1

Answer the question in this section.

1. (a) (i) Using the focal point method, construct an ellipse given that the major axis is 98 mm and the distance between the focal points is 70 mm. **[5 marks]**

(ii) Construct a normal and a tangent to a Point, P, on the curve of the ellipse located in the top left-hand quadrant. **[4 marks]**

(iii) State the length of the minor axis. **[1 mark]**

(b) Figure 1 shows a pictorial projection of a sliding tool with the front view identified by Arrow X.

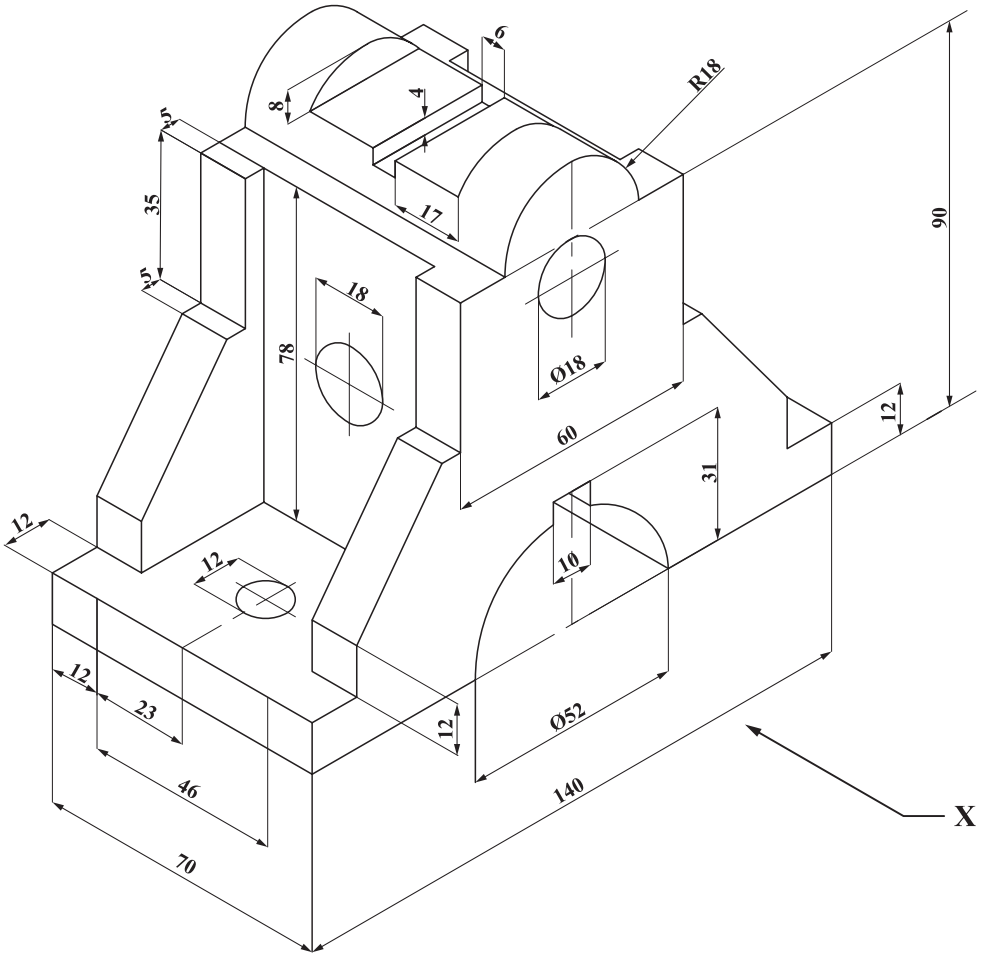

Figure 1. Sliding tool

(i) Using the given dimensions, draw EACH of the following views in first-angle orthographic projection

a) the front elevation **[5 marks]**

b) the plan view **[5 marks]**

c) the end elevation as seen from the right side **[5 marks]**

(ii) Label and show EIGHT dimensions. **[4 marks]**

(iii) Identify the projection used by the symbol. **[1 mark]**

Total 30 marks

SECTION B

MODULE 2 — GEOMETRY 2

Answer the question in this section.

2. (a) Figure 2 shows a bearing support drawn in third-angle orthographic projection.

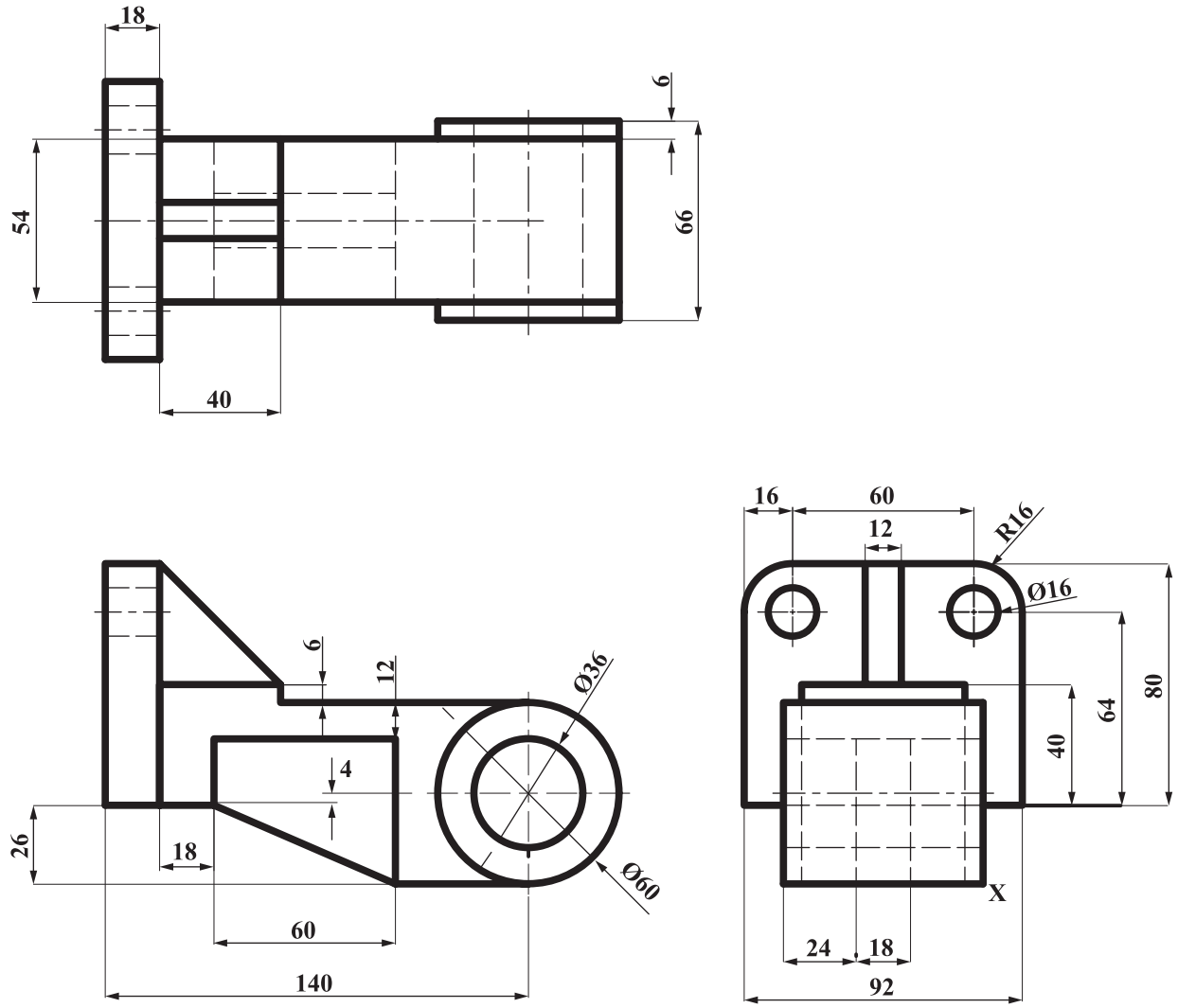

Figure 2. Bearing support

Using the given dimensions, draw the isometric projection. Ensure that Point X is the lowest point. **[10 marks]**

(b) Figure 3 is a partially completed orthographic drawing showing the joining of a hexagonal prism onto a square-based prism.

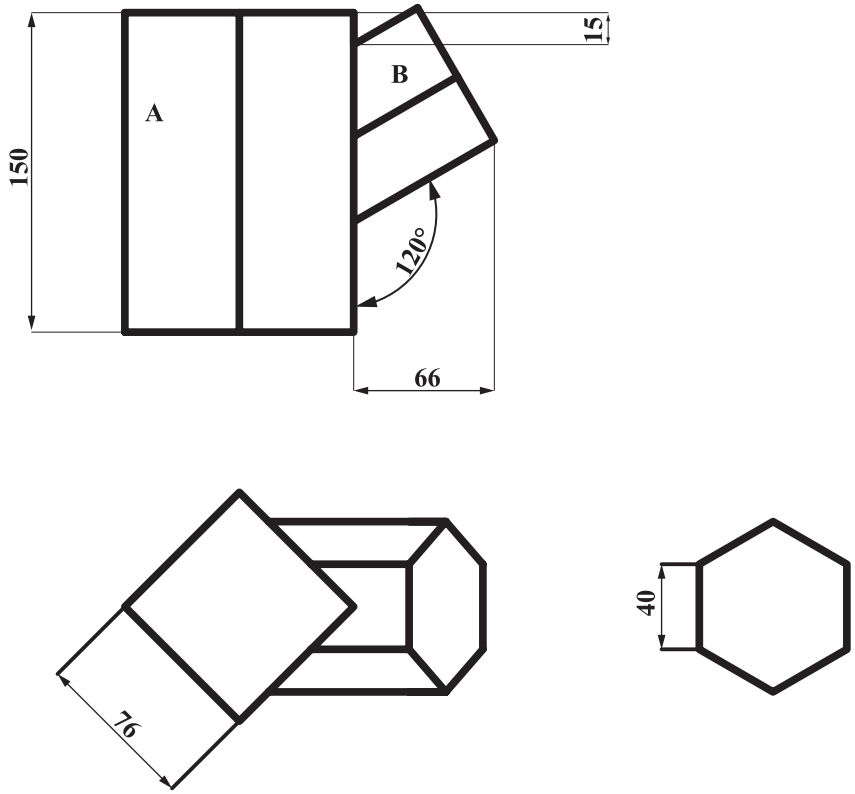

Figure 3. Partially completed orthographic drawing

Using a suitable scale, produce EACH of the following.

(i) The completed diagram, showing the lines of interpenetration when Shape A is interpenetrated by Shape B **[10 marks]**

(ii) The development of Shape A **[5 marks]**

(iii) The development of Shape B **[5 marks]**

Total 30 marks

SECTION C

MODULE 3B — BUILDING DRAWING

Answer the question in this section.

3. Figure 4 and Figure 5 show the proposed floor and slab reinforcement plans for the expansion of a studio unit.

(a) Draw the section D–D through the roof slab to a scale of 1:25. **[8 marks]**

(b) Draw Sectional elevation 1–1. **[12 marks]**

(c) Outline TWO reasons for the importance of reinforcement spacing in concrete slabs. **[4 marks]**

(d) Explain how the building orientation on the site can affect natural ventilation and thermal comfort. **[6 marks]**

Total 30 marks

END OF TEST

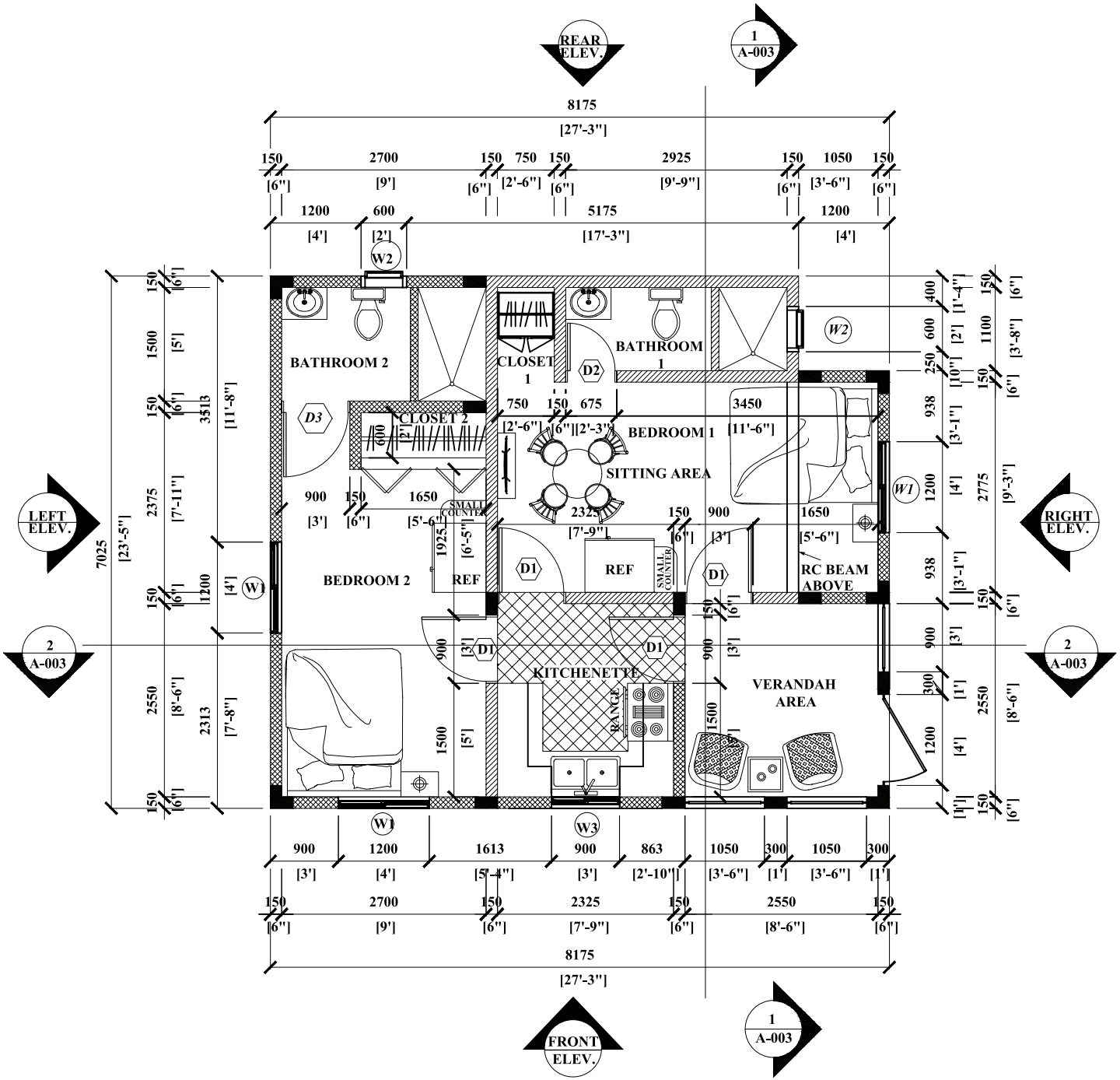

Figure 4. Proposed floor plan

SCALE 1:50
FLOOR AREA – 602.02 SQ. FT

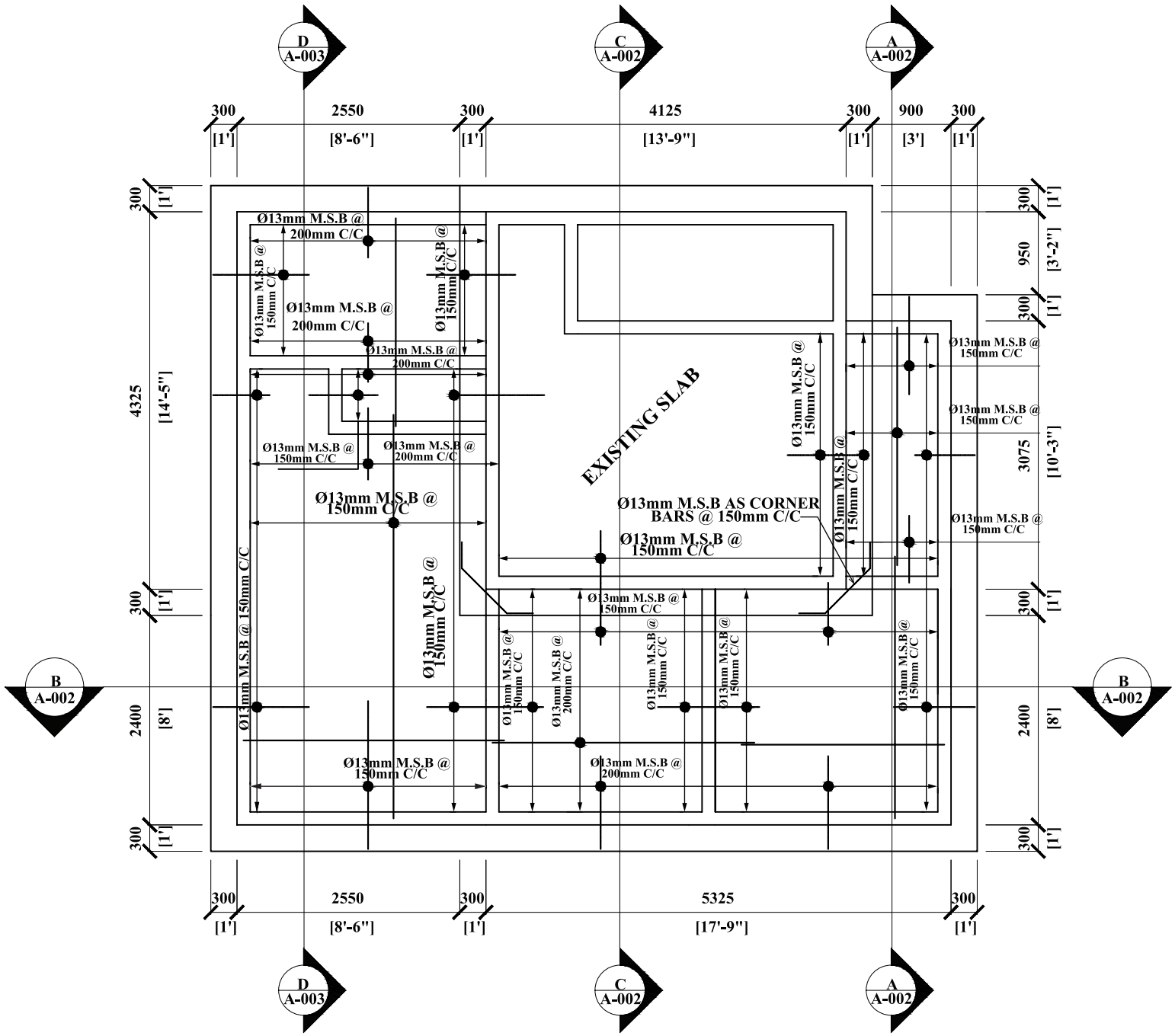

Figure 5. Slab reinforcement plan

SCALE 1:50

C A R I B B E A N E X A M I N A T I O N S C O U N C I L

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BUILDING AND MECHANICAL ENGINEERING DRAWING

OPTION B — BUILDING DRAWING

UNIT 1 — Paper 02

KEY AND MARK SCHEME

SPECIMEN 2026

BUILDING AND MECHANICAL ENGINEERING

UNIT 1 — Paper 02

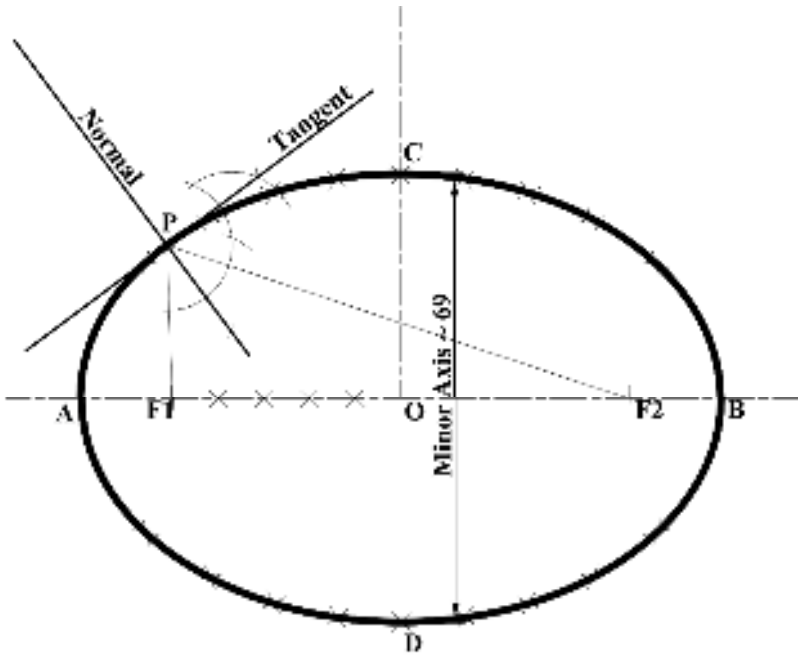
KEY AND MARK SCHEME

MODULE 1

Question 1.

Syllabus ref: 1.1.3(a &(b), 1.1.6(a)

(a)(i) — (iii)



9 marks for accurately drawing an ellipse with normal and tangent
1 mark for accurately stating the length of the minor axis — 69 mm

[10 marks]

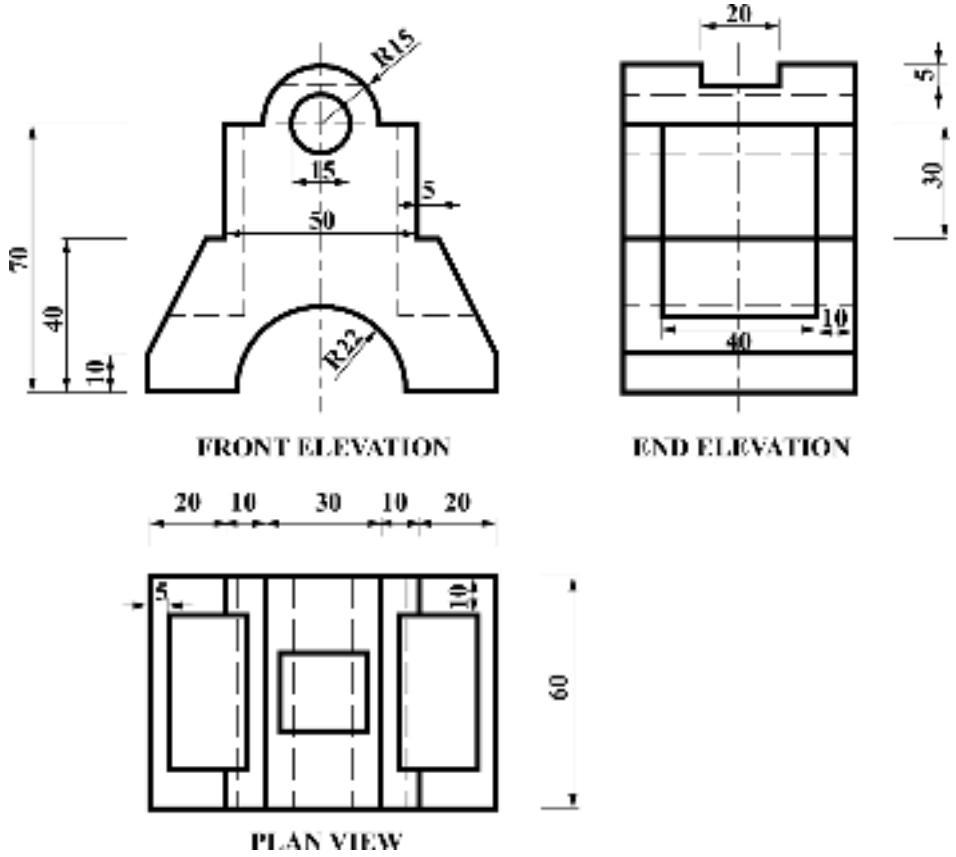
BUILDING AND MECHANICAL ENGINEERING

UNIT 1 — Paper 02

KEY AND MARK SCHEME

Question 1. (continued)

(b) (i) – (v)



5 marks for each diagram correctly drawn (up to a maximum of 15 marks)
4 marks for any eight dimensions labelled
1 mark for the projection symbol clearly shown

[20 marks]

Total 30 marks

BUILDING AND MECHANICAL ENGINEERING

UNIT 1 — Paper 02

KEY AND MARK SCHEME

Question 1. (continued)

		Criteria	**K**	**A**	**DS**
(a)	(i)	Drawing the ellipse	1	2	2
	(ii)	Drawing the normal and tangent	1	1	2
	(iii)	Stating the length of the minor axis	1		
(b)	(i)(a)	Drawing the front elevation	1	2	2
	(b)	Drawing the plan view	1	2	2
	(c)	Drawing the end elevation	1	2	2
	(ii)	Labelling and showing the dimensions	1	1	2
	(iii)	Showing the projection symbol	1		
			8	**10**	**12**

BUILDING AND MECHANICAL ENGINEERING

UNIT 1 — Paper 02

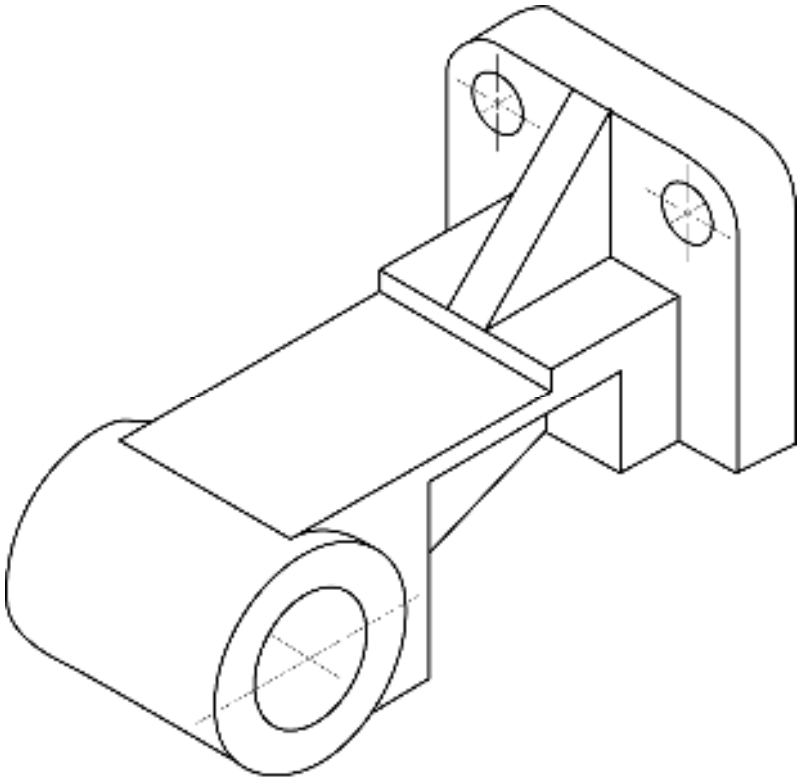
KEY AND MARK SCHEME

MODULE 2

Question 2.

Syllabus ref: 1.2.1(a)(iii), 1.2.3, 1.2.4(a)

(a)



9 marks for the completed drawing showing curves and circles
1 mark for showing Position X

[10 marks]

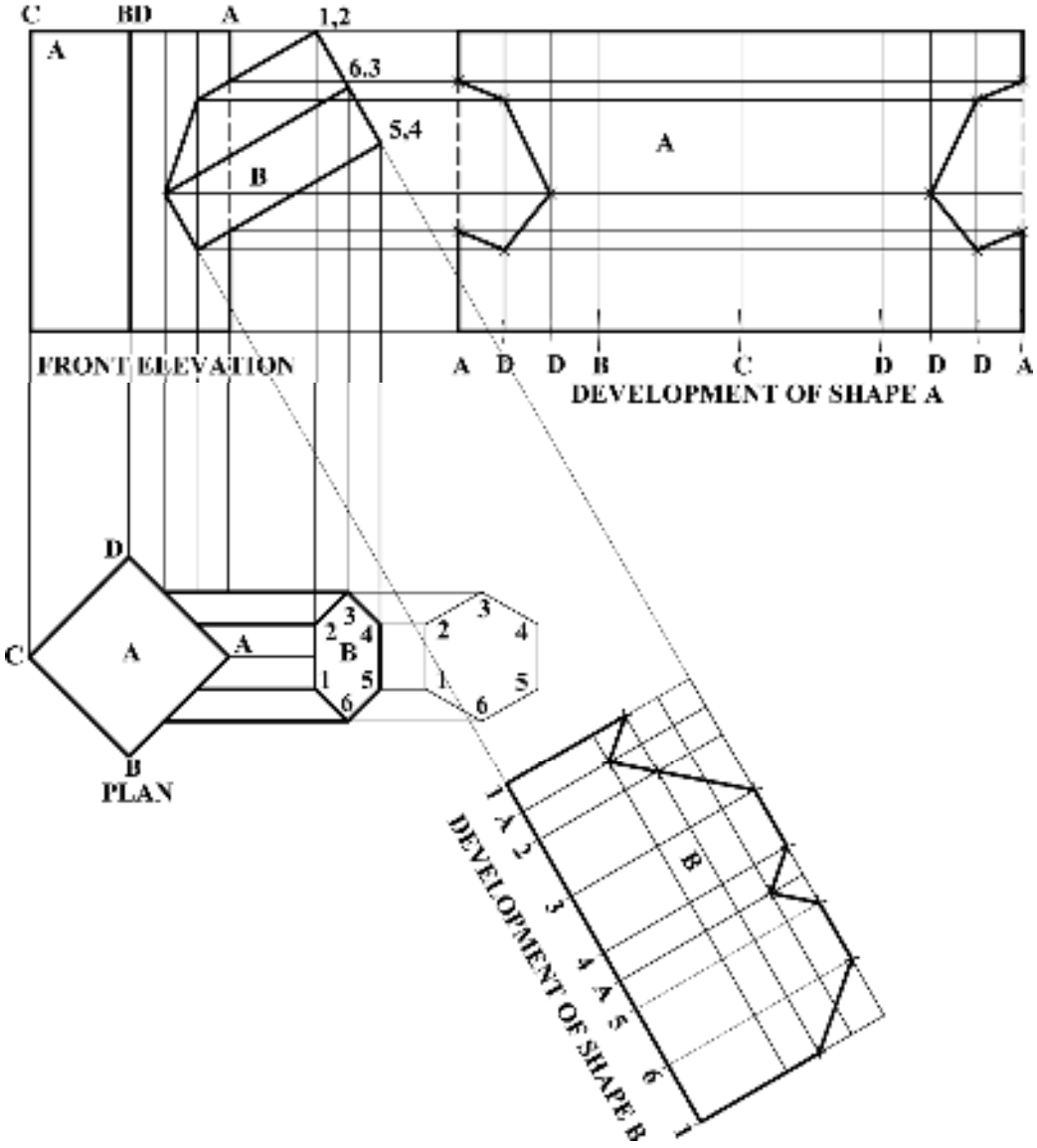
BUILDING AND MECHANICAL ENGINEERING

UNIT 1 — Paper 02

KEY AND MARK SCHEME

Question 2. (continued)

(b) (i), (ii) & (ii)



10 marks for the completed diagram
5 marks for the development of Shape A
5 marks for the development of Shape B

[20 marks]

Total 30 marks

BUILDING AND MECHANICAL ENGINEERING

UNIT 1 — Paper 02

KEY AND MARK SCHEME

Question 2. (continued)

		Criteria	**K**	**A**	**DS**
(a)		Drawing the isometric layout	1	1	2
		Drawing the isometric curves and circles	1	2	2
		Positioning X correctly	1		
(b)	(i)	Drawing the given diagram	1	2	2
		Drawing the lines of intersection	1	2	2
	(ii)	Drawing the development of A	1	2	2
	(iii)	Drawing the development of B	1	2	2
			7	**11**	**12**

BUILDING AND MECHANICAL ENGINEERING

UNIT 1 — Paper 02

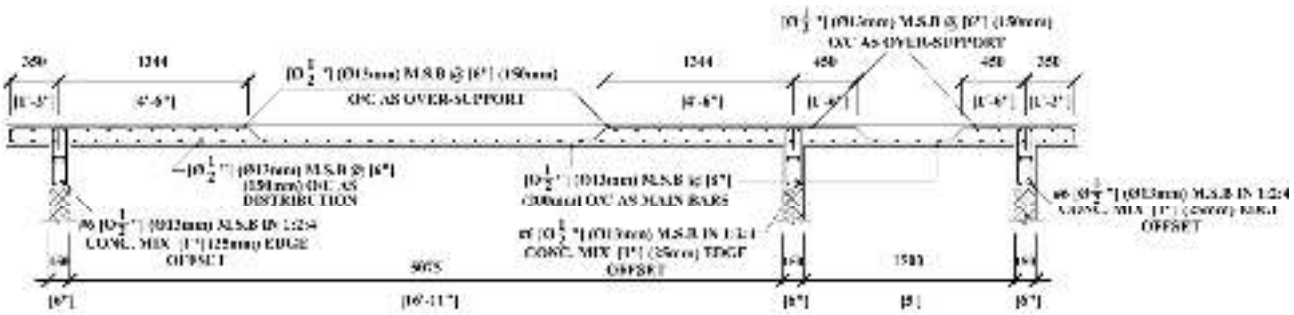
KEY AND MARK SCHEME

MODULE 3

Question 3.

Syllabus reference: 1.3B.2(a),1.3B.2(c),1.3B.1,2,3(a), 1.3B.3(d)

(a)



Slab Section D-D

[8 marks]

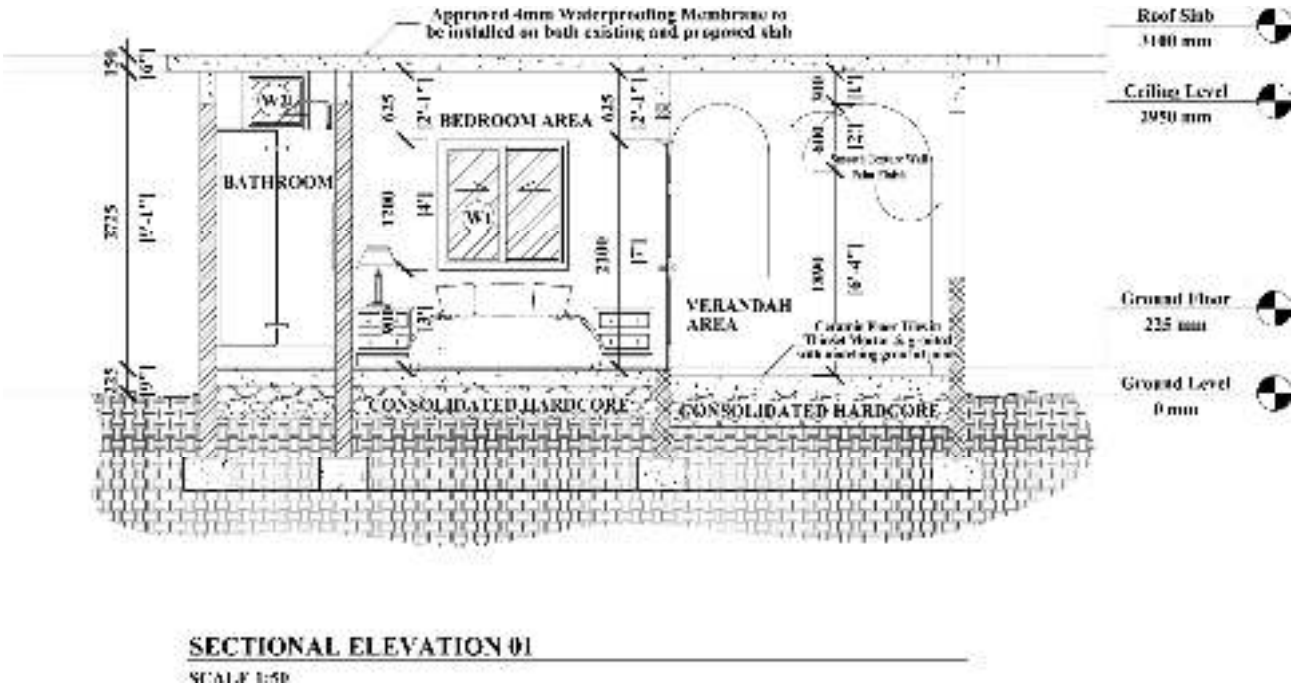
BUILDING AND MECHANICAL ENGINEERING

UNIT 1 — Paper 02

KEY AND MARK SCHEME

Question 3. (continued)

(b)



SECTIONAL ELEVATION 01

SCALE 1:50

[12 marks]

(c) Reasons for the importance of reinforcement spacing in concrete slabs.

Load Distribution — Concrete is strong in compression but weak in tension. Steel reinforcement (rebar) handles tensile forces, and proper spacing ensures these forces are distributed evenly across the slab rather than concentrated at isolated points.

Crack Control — Poorly spaced bars create weak zones where cracking is likely to initiate and propagate. Even well-designed slabs crack due to shrinkage, temperature changes and loading. Correct rebar spacing limits 'crack width' to acceptable levels — typically under 0.3 mm for normal exposure. Closely spaced bars distribute micro-cracking across many fine cracks rather than allowing a few wide, damaging ones.

Moment Resistance — In flexural members like slabs, the steel must be placed where tensile stresses develop. Spacing determines the effective steel area per unit width, which directly governs the slab's bending capacity.

Concrete Workability — If bars are spaced too closely, aggregate cannot pass through, leading to voids, honeycombing and reduced bond strength between steel and Concrete; this severely compromises structural integrity.

Question 3. (continued)

Bond and Anchorage — Adequate spacing allows the concrete to fully envelop each bar, developing the necessary bond stress for the steel and concrete to act compositely.

Durability — Proper spacing combined with adequate cover protects rebar from moisture and chlorides. Bars spaced too closely together can make it difficult to achieve uniform cover, accelerating corrosion over the lifespan of the structure.

1 mark each for identifying any two reasons (up to a maximum of 2 marks)
1 mark each for the corresponding explanation (up to a maximum of 2 marks)
[4 marks]

(d) Explain how the building orientation on the site can affect natural ventilation and thermal comfort.

Natural Ventilation

Building orientation plays a critical role in harnessing natural ventilation by determining how effectively prevailing winds are captured and channelled through interior spaces **(1)**. When a building is oriented so that its primary openings (windows, louvres and vents) face prevailing breezes, cross-ventilation is achieved naturally, drawing fresh air in through the windward facades and exhausting warm, stale air out through the leeward openings **(1)**. In tropical climates, where the northeast trade winds are a dominant and reliable feature, a building oriented to receive these winds can maintain comfortable interior temperatures without mechanical cooling **(1)**. Conversely, a building poorly oriented — having its solid walls facing the prevailing wind and its openings sheltered from it — will trap heat and stagnant air inside, forcing occupants to rely heavily on air conditioning **(1)**. The shape and layout of the building also interact with orientation; a long, narrow building that is oriented perpendicular to the prevailing wind allows the breeze to pass through its full depth, while a deep, blocky building facing away from the wind creates dead zones of still, uncomfortable air **(1)**. Surrounding site elements such as fences, dense vegetation and neighbouring structures can further block or redirect airflow, making orientation decisions inseparable from the broader site planning process **(1)**.

1 mark each for any three points used in explanation (up to a maximum of 3 marks)

BUILDING AND MECHANICAL ENGINEERING

UNIT 1 — Paper 02

KEY AND MARK SCHEME

Question 3. (continued)

Thermal Comfort

The orientation of a building on its site directly governs the amount and intensity of solar radiation that strikes its walls, roof and glazing throughout the day; this in turn has a profound effect on the thermal comfort of its occupants **(1).** In tropical and subtropical regions, the most problematic solar exposure comes from the east and west, where the sun sits low on the horizon in the morning and afternoon and strikes vertical wall surfaces with intense, difficult-to-shade radiation that heats building envelopes and raises interior temperatures **(1).** By orienting the building so that its longest facades face north and south rather than east and west, the designer dramatically reduces this unwanted heat gain, since the higher-angle midday sun striking south-facing walls is far more easily controlled with horizontal overhangs and shading devices **(1).** A building oriented with large glazed or poorly insulated walls facing west, for example, will absorb and radiate heat throughout the afternoon and into the evening, making interior spaces uncomfortably warm long after sunset **(1).** Beyond wall exposure, orientation also affects roof heat gain, ground-level shade patterns and the interaction of the building mass with cool night air; all of this contributes to the overall thermal environment experienced by occupants. When orientation is carefully considered alongside shading, thermal mass and material selection, the result is a building that stays naturally cool, reduces energy consumption and provides a comfortable environment without overreliance on mechanical systems **(1).**

1 mark each for any three points used in explanation (up to a maximum of 3 marks)

[6 marks]

Total 30 marks

Criteria		**K**	**A**	**DS**
(a)	Drawing Section D-D	2	2	4
(b)	Drawing Sectional elevation 1-1	2	2	8
(c)	Spacing the reinforcement in slabs		4	
(d)	Explaining how building orientation on the site can affect natural ventilation and thermal comfort	2	4	
		6	**12**	**12**

TEST CODE **02269010**

SPECIMEN 2026

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BUILDING AND MECHANICAL ENGINEERING DRAWING

OPTION B — BUILDING DRAWING AND DESIGN

UNIT 2 — Paper 01

1 hour 30 minutes

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This test consists of 45 items. You will have 1 hour and 30 minutes to answer them.
2. In addition to this test booklet, you should have an answer sheet.
3. Do not be concerned that the answer sheet provides spaces for more answers than there are items in this test.
4. Each item in this test has four suggested answers lettered (A), (B), (C), (D). Read each item you are about to answer and decide which choice is best.
5. On your answer sheet, find the number which corresponds to your item and shade the space having the same letter as the answer you have chosen. Look at the sample item below.

   Sample Item

   Which of the following is NOT a stage of the design process?

   (A) Synthesis
   (B) Evaluation
   (C) Presentation
   (D) Coordination

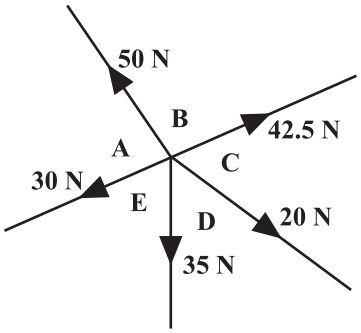
   Sample Answer

   The best answer to this item is "Coordination", so (D) has been shaded.
6. If you want to change your answer, erase it completely before you fill in your new choice.
7. When you are told to begin, turn the page and work as quickly and as carefully as you can. If you cannot answer an item, go on to the next one. You may return to that item later.
8. You may do any rough work in this booklet.
9. Figures are not necessarily drawn to scale.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

Item **1** refers to the following diagram of a system of forces.



1. From a visual inspection of the diagram, which of the following statements is true?

(A) The system is in equilibrium.
(B) The resultant of the system is 177.5 N.
(C) Force AB has no vertical component.
(D) Force ED has no horizontal component.

2. A concrete column whose cross-sectional area is 400 mm × 400 mm is subjected to an axial thrust of 800 kN. What is the stress in the concrete?

(A) 2 N/mm^2
(B) 5 N/mm^2
(C) 8 N/mm^2
(D) 10 N/mm^2

3. Which of the following statements is true about a couple?

(A) Consists of two unequal forces acting in line with each other
(B) Its moment is 2 × force × perpendicular distance between the forces
(C) Consists of two equal unlike parallel forces acting out of line
(D) Can be balanced by a single force of the same moment as the couple

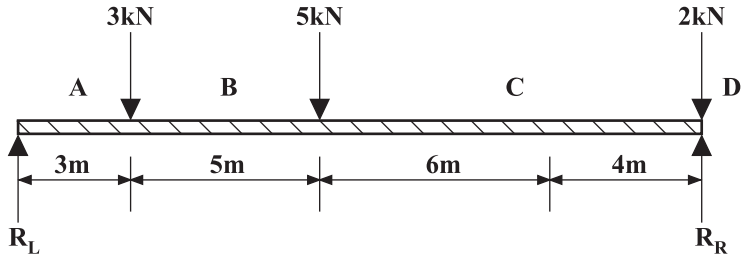
4. Which force member can carry loads in the event that variations are introduced in the normal external loading configuration?

(A) Concurrent
(B) Coplanar
(C) True
(D) Zero

5. When the net resultant of opposing forces on a beam is zero, the forces are said to be

(A) in equilibrium
(B) in alignment
(C) linked
(D) static

Items **6** and **7** refer to the following diagram which shows forces acting on a beam.



6. Which of the following is the resultant of R_L?

(A) 4.72 kN
(B) 5.27 kN
(C) 7.0 kN
(D) 8.0 kN

7. Which of the following is the resultant of R_R?

(A) 4.72 kN
(B) 5.27 kN
(C) 7.0 kN
(D) 8.0 kN

---

8. Which of the following terms is used to indicate the total rise of a staircase?

(A) Lift
(B) Riser
(C) Going
(D) Travel

9. In an effort to minimize twisting and general movement of joists, members are placed between them. Which of the following is/are NOT a method of placing members between joists?

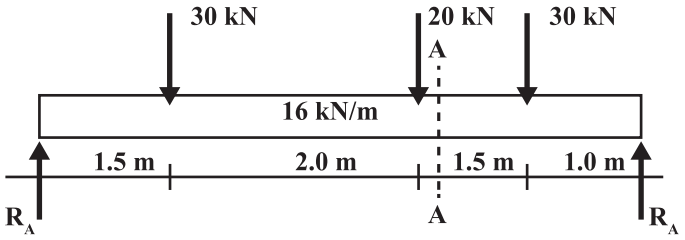
(A) Inline
(B) Noggins
(C) Staggered
(D) Herringbone

10. An extended tread found between two consecutive flights of stairs is known as a

(A) riser
(B) landing
(C) handrail
(D) newel post

GO ON TO THE NEXT PAGE

Item **11** refers to the following diagram of a beam supporting UDLs and point loads.



11. Which equation represents the shear force (SF) for the left of Section A–A?

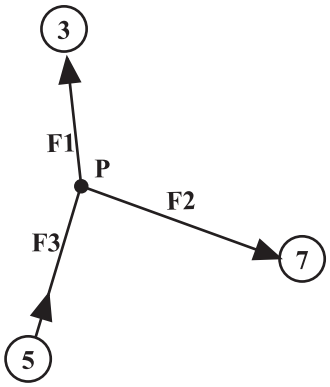
(A) $SF = R_A - 30\ kN - 20\ kN - 16x\ kN/m \cdot x_1$

(B) $SF = R_A + 30\ kN + 20\ kN + 16x\ kN/m \cdot x_1$

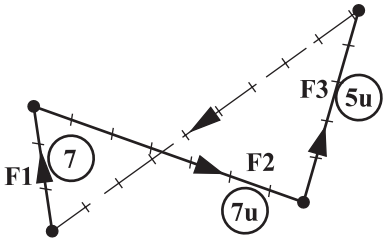
(C) $SF = R_A - 30\ kN - 20\ kN - 16x\ kN/m$

(D) $SF = R_A + 30\ kN + 20\ kN + 16x\ kN/m$

Item **12** and **13** refer to the following diagrams showing three forces acting at a point and a vector polygon resolving the forces.



Three forces acting at a point



Vector polygon

12. What is the magnitude of the force that will bring stability to the system of forces?

(A) 7.3μ
(B) 8.3μ
(C) 9.3μ
(D) 10.3μ

13. Which type of force system is represented?

(A) Parallel
(B) Coplanar
(C) Structured
(D) Concurrent

14. A household septic tank begins to show signs of failure. The soakaway area becomes waterlogged, effluent surfaces at ground level and sinks drain slowly. Inspection shows the tank itself has adequate sludge and scum layers within normal limits and the inlet/outlet pipes are clear.

What is the MOST likely cause of the failure of the septic tank?

(A) High water table intruding into the field
(B) Root intrusion into the distribution pipes
(C) Biomat clogging in the soil absorption field
(D) Excessive detergent use reducing soil permeability

15. Foundations are placed ground level to increase a structure's

(A) strength
(B) stability
(C) aesthetics
(D) workability

16. Ramming a stiff dry cement mortar mix into the space between new underpinning work and an existing structure is known as

(A) final pinning
(B) pretest pinning
(C) Pynford pinning
(D) wall underpinning

17. The method of underpinning that uses pairs of jacks or bored piles in conjunction with a reinforced beam is known as

(A) the Pynford stooling method
(B) traditional underpinning
(C) wall underpinning
(D) needle and pile

18. A load of wet concrete is considered to be approximately

(A) 1 400 kg/m^3
(B) 2 400 kg/m^3
(C) 3 400 kg/m^3
(D) 4 400 kg/m^3

19. Which of the following types of paint is MOST suitable for the application of a **first** coat to an external grill to seal the surface and protect it from damp air?

(A) Priming paint
(B) Finishing paint
(C) Undercoating paint
(D) Water-based paint

20. Which of the following is the number of days concrete takes to reach its compressive strength?

(A) 3
(B) 7
(C) 28
(D) 32

21. The recommended slump for mass concrete is

(A) 25 mm to 50 mm
(B) 50 mm to 100 mm
(C) 100 mm to 125 mm
(D) 125 mm to 150 mm

GO ON TO THE NEXT PAGE

22. The MOST important element affecting the strength of concrete is the

(A) method of mixing
(B) water-to-cement ratio
(C) volume of the mixture
(D) weather condition during curing

23. In order for a material to have elasticity, it must

(A) not change shape or size
(B) have a heavy weight that never changes
(C) change in shape and size, and return to its original state
(D) continue to stretch as much as possible and never return to its original state

24. Which of the following ingredients of paint provides body, colour and durability?

(A) Pigment
(B) White lead
(C) Linseed oil
(D) Synthetic resin

25. Which of the following types of cement has the BEST resistance to natural sulphates found in some subsoils?

(A) OPC
(B) CPC
(C) RHPC
(D) SRPC

26. Thermal insulation is defined as the

(A) measure of a material's ability to resist heat
(B) measure of a material's ability to transmit heat
(C) freedom for the natural flow of heat to move to a higher temperature source
(D) barrier to the natural flow of heat moving from an area of high temperature to an area of low temperature

27. Which of the following concrete mixes gives the **strongest** reinforced concrete for a flight of steps?

(A) 1:2:4
(B) 1:3:6
(C) 1:2:8
(D) 1:5:10

28. Which of the following is the correct order for the stages of project management?

(A) Scoping, planning, launching, monitoring and closing
(B) Planning, scoping, launching, closing and monitoring
(C) Launching, planning, scoping, monitoring and closing
(D) Scoping, planning, monitoring, launching and closing

29. Which of the following factors should be considered when selecting cementitious materials?

I. Cost
II. Quality
III. Compressive strength

(A) I and II only
(B) I and III only
(C) II and III only
(D) I, II and III

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30. A building's primary electric service system is usually sized on the basis of the

(A) connected load
(B) transformer rating
(C) number of lights used
(D) number of rooms to be lighted

31. Which of the following is NOT a stage of the design process?

(A) An approximation of project time and cost targets, refined throughout the project life cycle
(B) A prediction of a future condition or event based on information or knowledge available now
(C) The value of useful work done at any given point in a project to give a measure of progress
(D) A situation that affects or influences the outcome of the project expressed in time or cost terms

32. The accuracy of a project estimate should

(A) stay constant throughout the project life cycle
(B) decrease as a project progresses through its life cycle
(C) increase as a project progresses through its life cycle
(D) vary independently of where the project is in its life cycle

33. A key aspect of managing a project involves

(A) identifying routine tasks
(B) planning to achieve defined objectives
(C) ensuring ongoing operations are maintained
(D) defining the operational systems to be put in place

34. Project scheduling can BEST be defined as the process used to determine

(A) overall project duration
(B) project cost estimating
(C) the project management plan
(D) the subcontractor's responsibilities

35. During project planning, execution involves taking actions to

(A) establish a good plan
(B) close out the project
(C) provide feedback to key vendors
(D) ensure that activities in the project plan are completed

36. Which of the following is the **final** stage in the designing process?

(A) Analysis
(B) Synthesis
(C) Evaluation
(D) Presentation

37. Which of the following lists the correct sequence for distributing electrical power in a domestic dwelling?

(A) Fuse, switch, load
(B) Load, fuse, switch
(C) Fuse, load, switch
(D) Switch, load, fuse

38. If a 70 g sample of timber weighs 40 g after seasoning, what is the current moisture content of the sample?

(A) 30 g
(B) 110 g
(C) 70%
(D) 75%

GO ON TO THE NEXT PAGE

39. Which of the following describe the design principles of a blueprint?

I. Aesthetics
II. Accessibility
III. Cost efficiency

(A) I and II only
(B) I and III only
(C) II and III only
(D) I, II and III

40. The purpose of the preconstruction conference is to

(A) negotiate costs and sign the contract
(B) assign work to equipment operators
(C) agree on the project's requirements
(D look at the equipment to be used

41. Which of the following is NOT an appropriate internal wall finish?

(A) Tile
(B) Paint
(C) Cladding
(D) Concrete block

42. For which of the following is a hollow-core wooden door BEST suited?

(A) A door in a private office
(B) A residential interior door
(C) A residential exterior door
(D) A twenty-minute smoke barrier door

43. In using the design concept, what term is used to describe the functional aspect of the design?

(A) Cost
(B) Aesthetics
(C) Ergonomics
(D) Anthropometrics

44. Which of the following terms is used to describe the appearance/beautification of a design?

(A) Cost
(B) Aesthetics
(C) Ergonomics
(D) Anthropometrics

45. In the design process, optimization is the process of

(A) ensuring all the design parts fit
(B) testing a design for best results
(C) revealing all the features of the design
(D) creating all the ideas needed to complete the design

END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.

C A R I B B E A N E X A M I N A T I O N S C O U N C I L

CARIBBEAN ADVANCED PROFICIENCY EXAMINATION

BUILDING AND MECHANICAL ENGINEERING DRAWING

OPTION B — BUILDING DRAWING AND DESIGN

UNIT 2

SPECIMEN PAPER 2026

Item No.	Key	Specific Objective
1	D	2B:1:1
2	B	2B:1:2
3	C	2B:1:1
4	D	2B:1:1
5	A	2B:1:2
6	B	2B:1:1
7	A	2B:1:1
8	A	2B:1:4
9	B	2B:1:4
10	B	2B:1:4
11	A	2B:1:1
12	C	2B:1:1
13	B	2B:1:1
14	A	2B:1:4
15	B	2B:1:3
16	A	2B:2:1
17	D	2B:2:1
18	B	2B:2:1
19	A	2B:2:1
20	C	2B:2:2
21	A	2B:2:3
22	B	2B:2:1
23	C	2B:2:2

Item No.	Key	Specific Objective
24	A	2B:2:1
25	D	2B:2:1
26	D	2B:2:2
27	A	2B:2:3
28	A	2B:2:7
29	D	2B:2:3
30	A	2B:2:4
31	A	2B:3:1
32	C	2B:3:1
33	B	2B:3:1
34	A	2B:3:1
35	D	2B:3:1
36	D	2B:3:2
37	A	2B:3:2
38	D	2B:3:1
39	D	2B:3:3:
40	C	2B:3:1
41	D	2B: 3: 4
42	B	2B:3:4
43	C	2B:3:2
44	B	2B:3:2
45	B	2B:3:2

CARIBBEAN EXAMINATIONS COUNCIL

BUILDING AND MECHANICAL ENGINEERING DRAWING

OPTION B – BUILDING DRAWING

UNIT 02 – PAPER 02

TABLE OF SPECIFICATIONS

SPECIMEN

Module	Content	Ques. No.	Objectives	Profiles and Marks			Total
				Knowledge	Application	Drawing Skills	
1	Forces in structures using an analytical method	**1 (a)**	2.1B.1a	1	4		5
	Shear force and bending moment diagrams	**(b) (i)** **(ii)**	2.1B.2a	1 1	2	6	10
		(c)	2.1B.2a	1	4		6
	Structural drawings to a suitable scale	**(d)**	2.1.4f	1	2	7	10
Subtotal				**5**	**12**	**13**	**30**
2	Types of construction materials	**2(a)** **(i)** **(ii)**	2.2B.1m (i)-(iv)	1	4		**5**
		(b)	2.2B.1m (i)-(iv)	2	4	4	10
	Building construction processes	**(c) (i)** **(ii)**	2.2B.5	3 2	6		11
	Common properties associated with building construction materials.	**(d)**	2.2B.2a	2	2		**4**
Subtotal				**10**	**16**	**4**	**30**

Module	Content	Ques. No.	Objectives	Profiles and Marks			Total
				Knowledge	Application	Drawing Skills	
3	Basic principles of construction management	**(a) (i)** **(ii)**	2.3B.1.a,b	1 1	6	2	**10**
	Construction management process	**(b) (i)** **(ii)**	2.3B.2	3 1	4 8	4	**20**
Subtotal				**6**	**18**	**6**	**30**
Total				**21**	**46**	**23**	**90**

TEST CODE **02269020**

SPECIMEN 2026

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BUILDING AND MECHANICAL ENGINEERING DRAWING

OPTION B — BUILDING DRAWING AND DESIGN

UNIT 2 — Paper 02

2 hours 30 minutes

GENERAL INFORMATION

1. This paper consists of THREE questions in THREE sections. Answer ALL questions.
2. Silent, non-programmable calculators may be used for this examination.
3. For this examination, each candidate should have the following.

   A minimum of six sheets of 11" × 17" paper
   Personal computer with monitor, keyboard, mouse and printer
   Computer-aided drafting software

   NOTE: After completing EACH question, save your work electronically as a pdf file on the available storage device. At the conclusion of the examination, the invigilator will give you instructions for submitting the saved files for printing. All work MUST be printed for submission.

INSTRUCTIONS TO CANDIDATES

1. All dimensions given are in millimetres unless otherwise stated.
2. Where scales are not stated, the full size should be applied.
3. All geometrical construction lines MUST be visible on all drawings.
4. When first-angle or third-angle is not specified, the choice of projection is left to the candidate's discretion, in which case the type of projection used MUST be clearly stated.
5. The candidate should use his/her own judgement to supply any dimensions or other details not directly shown on the drawings.
6. The number of each question MUST be written next to the solution.
7. Each candidate MUST enter his/her school code and registration number in the appropriate space at the bottom of the drawing paper.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

SECTION A

MODULE 1 — STRUCTURAL DRAWINGS

Answer the question in this section.

1. Figure 1 shows a simply supported beam loaded with two point loads (PLs) and one uniformly distributed load (UDL).

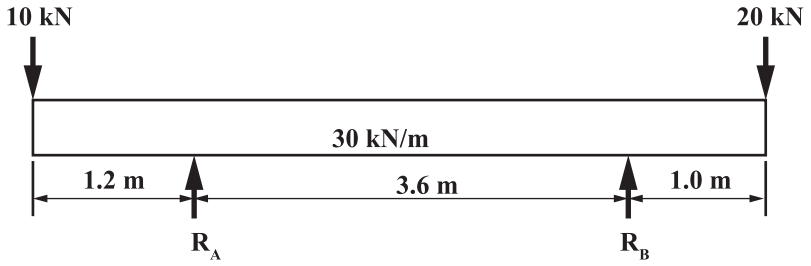

Figure 1. Simply supported beam

(a) Calculate the magnitude of the reactions R_A and R_B. **[5 marks]**

(b) (i) Produce the shear force diagram (SFD) for the beam. **[9 marks]**

(ii) State the point of SF = 0. **[1 mark]**

(c) Calculate the maximum bending moment (BM_{max}) corresponding with the point identified in (b) (ii). **[5 marks]**

(d) Figure 2 shows the plan of an L-shaped staircase.

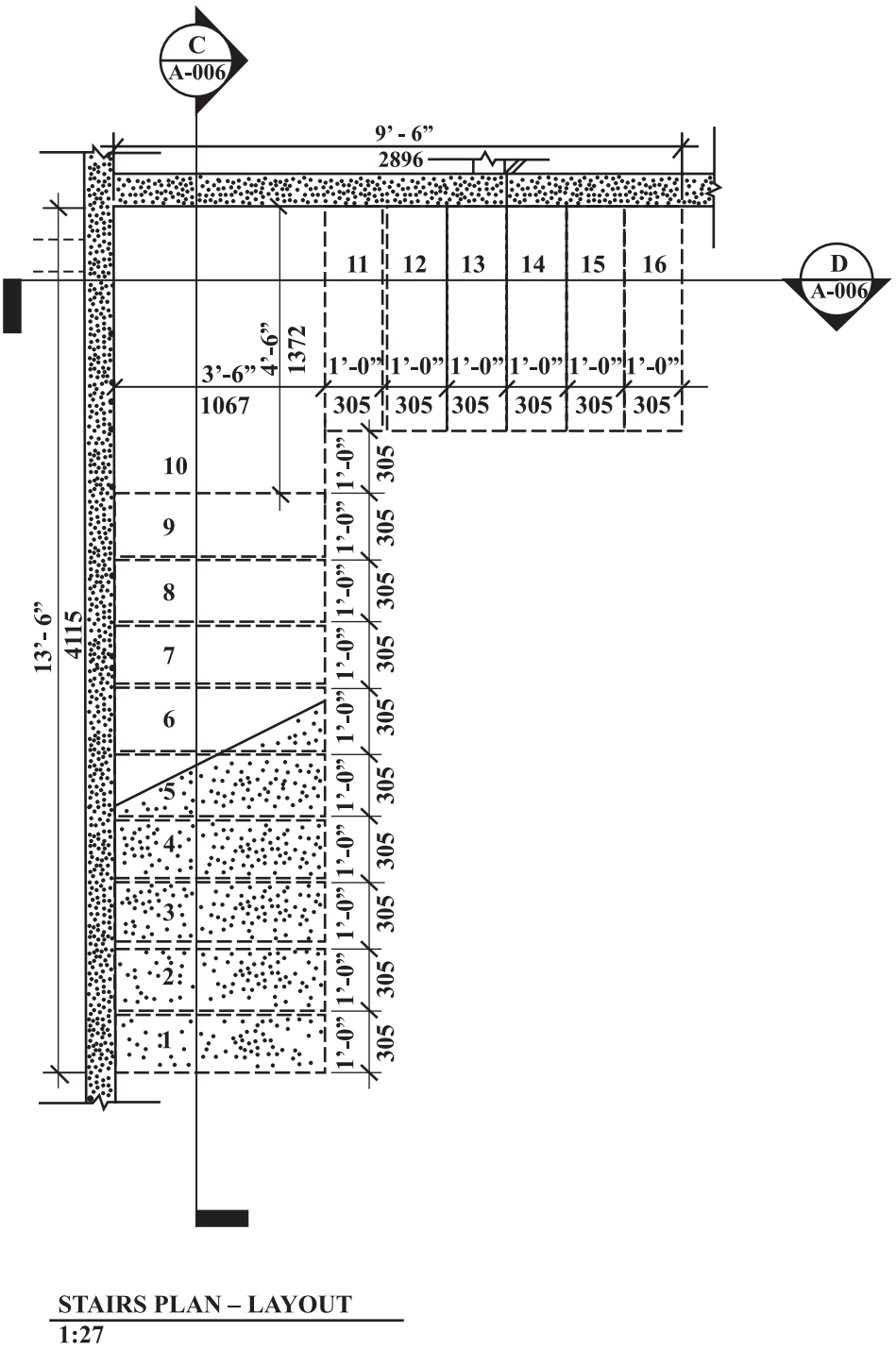

Figure 2. An L-shaped staircase

Draw Section C–C to a scale of 1:25. **[10 marks]**

Total 30 marks

GO ON TO THE NEXT PAGE

SECTION B

MODULE 2 — BUILDING MATERIALS AND PROCESSES

Answer the question in this section.

2. (a) You are tasked with constructing a small outdoor patio in an area prone to heavy rainfall.

(i) State the MOST suitable type of cement for the project. **[1 mark]**

(ii) Provide a justification for your response in (a) (i), based on the properties and performance of the cement in wet conditions. **[4 marks]**

(b) Draw a flowchart to show the similarities and differences between the wet and dry processes of cement production. **[10 marks]**

(c) A carpenter is constructing a gable roof that is 24 feet long (7200 mm). The rafters are to be spaced 16 inches (400 mm) apart on centre.

(i) Calculate the number of common rafters needed for one side of the roof. **[9 marks]**

(ii) Determine the TOTAL number of common rafters required for both sides. **[2 marks]**

(d) During the construction of a long concrete pavement in a hot climate, the engineer is concerned about cracks forming due to thermal expansion. Outline TWO methods that can be used to manage thermal expansion in concrete structures and explain how these methods can help prevent damage. **[4 marks]**

Total 30 marks

SECTION C

MODULE 3 — MANAGEMENT AND DESIGN

Answer the question in this section.

3. (a) Table 1 shows the activities for a construction project.

TABLE 1: PROJECT ACTIVITIES

Activity	Estimated Time (months)
1–2	3
1–3	6
1–4	3
2–5	5
3–6	7
3–7	10
4–7	4
5–8	2
6–8	5
7–9	6
8–9	4

(i) Using Table 1, draw the network diagram. **[9 marks]**

(ii) Determine the critical path for the project. **[1 mark]**

(b) Table 2 shows the activities, their estimated duration and predecessors for a construction project.

TABLE 2: ACTIVITIES, ESTIMATED DURATION AND PREDECESSORS

Activity		Duration (Months)	Predecessors
A	Excavation	4	–
B	Reduce level	6	A
C	Pour concrete	9	A
D	Order Material	2	A
E	Dam Wall	3	B
F	Install pipe	8	B
G	Foundation	10	C
H	Rendering	4	G
I	Painting	2	E, D

(i) Construct the project activity network using the AON methodology. Label EACH node appropriately. **[11 marks]**

(ii) Calculate the early start, early finish, late start and late finish for EACH activity. **[9 marks]**

Total 30 marks

END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.

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BUILDING AND MECHANICAL ENGINEERING DRAWING

OPTION B – BUILDING DRAWING AND DESIGN

UNIT 2 — Paper 02

KEY AND MARK SCHEME

SPECIMEN 2026

BUILDING AND MECHANICAL ENGINEERING DRAWING
UNIT 2 — Paper 02
KEY AND MARK SCHEME

MODULE 1

Question 1.

Syllabus reference: 2.1B.1a, 2.1B.2a, 2.1B.2a

(a)

$$R_A + R_B = 10\ kN + 20\ kN + 30\ \ kN/m \cdot 5.8\ m$$

$$R_A + R_B = 204\ kN$$

$$R_A = 204\ kN - R_B$$

$$\therefore R_A = 204\ kN - 104.0\ kN$$

$$R_A = 100\ kN$$

1 mark for completed equation
1 mark for the correct answer

Taking moments @ pt. R_A

$$10\ kN \times 1.2\ m + R_B \times 3.6\ m = 30\ \ kN/m \times 5.8\ m \times 1.7\ m + 20\ kN \times 4.6\ m$$

$$12\ kNm + R_B \times 3.6\ m = 295.8\ kNm + 92\ kNm$$

$$R_B \times 3.6\ m = 295.8\ kNm + 92\ kNm - 12\ kNm$$

$$R_B \times 3.6\ m = 375.8\ kNm$$

$$R_B = \frac{375.8\ kNm}{3.6\ m}$$

$$R_B = 104.389\ kN$$

$$R_B = 104.0\ kN$$

1 mark for completed equation
2 marks for the correct answer

[5 marks]

BUILDING AND MECHANICAL ENGINEERING DRAWING
UNIT 2 — Paper 02
KEY AND MARK SCHEME

Question 1. (continued)

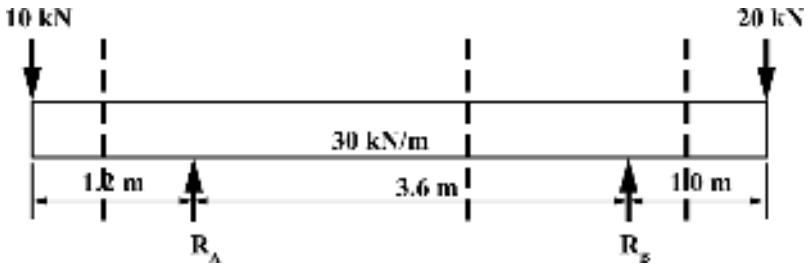
(b) (i) Shear Force (SF) Values

Considering left of Section 1–1

$$SF = -10\ kN - 30\ kN/m \cdot x_1$$

When $x_1 = 0\ m$

$$SF = -10\ kN - 30\ kN/m \cdot 0\ m$$
$$SF = -10\ kN$$



6 marks for diagram

When $x_1 = 1.2\ m$

$$SF = -10\ kN - 30\ kN/m \cdot 1.2\ m$$
$$SF = -10\ kN - 36\ kN$$
$$SF = -46\ kN$$

Considering left of Section 2–2

$$SF = -10\ kN + R_A - 30\ kN/m \cdot x_2$$

When $x_2 = 1.2\ m$

$$SF = -10\ kN + 100\ kN - 30\ kN/m \cdot 1.2\ m$$
$$SF = -10\ kN + 100\ kN - 36\ kN$$
$$SF = 54\ kN$$

When $x_2 = 3\ m$

$$SF = -10\ kN + 100\ kN - 30\ kN/m \cdot 3\ m$$
$$SF = -10\ kN + 100\ kN - 90\ kN$$
$$\underline{\boldsymbol{SF = 0\ kN}}$$

1 mark for the correct answer

BUILDING AND MECHANICAL ENGINEERING DRAWING
UNIT 2 – Paper 02
KEY AND MARK SCHEME

Question 1. (continued)

When $x_2 = 4.8\,m$

$$SF = -10\,kN + 100\,kN - 30\,kN/m \cdot 4.8\,m$$

$$SF = -10\,kN + 100\,kN - 144\,kN$$

$$SF = -54\,kN$$

Considering left of Section 3-3

$$SF = -10\,kN + R_A + R_B - 30\,kN/m \cdot x_3$$

When $x_2 = 4.8\,m$

$$SF = -10\,kN + 100\,kN + 104\,kN - 30\,kN/m \cdot 4.8\,m$$

$$SF = -10\,kN + 204\,kN - 144\,kN$$

$$SF = 50\,kN$$

When $x_2 = 5.8\,m$

$$SF = -10\,kN + 100\,kN + 104\,kN - 30\,kN/m \cdot 5.8\,m$$

$$SF = -10\,kN + 204\,kN - 174\,kN$$

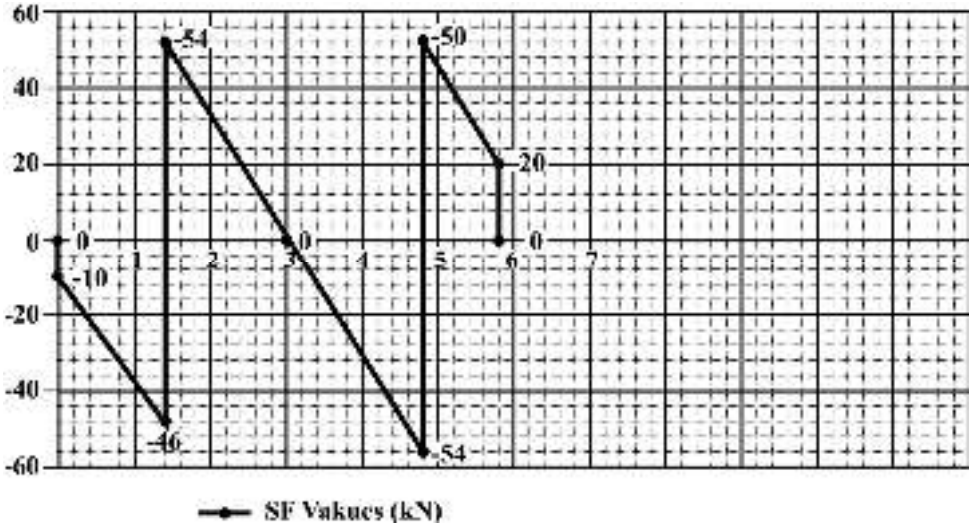
$$SF = 20\,kN$$

At the end of the beam

$$SF = -10\,kN + 100\,kN + 104\,kN - 30\,kN/m \cdot 5.8\,m + 20\,kN$$

$$SF = 0\,kN$$

1 mark for the correct answer



1 mark for accurate graph **[9 marks]**

BUILDING AND MECHANICAL ENGINEERING DRAWING
UNIT 2 — Paper 02
KEY AND MARK SCHEME

Question 1. (continued)

(ii) Identifying the Point of Zero Shear Force

Within Section 2–2, the SF diagram value is equal to zero '0' at 3 m from Reaction R_A. **[1 mark]**

(c) Calculating the Maximum Bending Moment

At this point of zero shear force, 3 m from the left reaction R_A, the maximum Bending Moment (BM) is also occurring.

$$BM = -10\,kN \cdot 3\,m + R_A \cdot 1.8\,m - 30\,kN/m \cdot 5.8\,m \cdot (3\,m - 2.9\,m) - R_B \cdot 1.8\,m + 20\,kN \cdot 2.8\,m$$

$$BM = -30\,kNm + 180\,kNm - 17.4\,kNm - 187.2\,kNm + 56\,kNm$$

$$BM = 1.4\,kNm$$

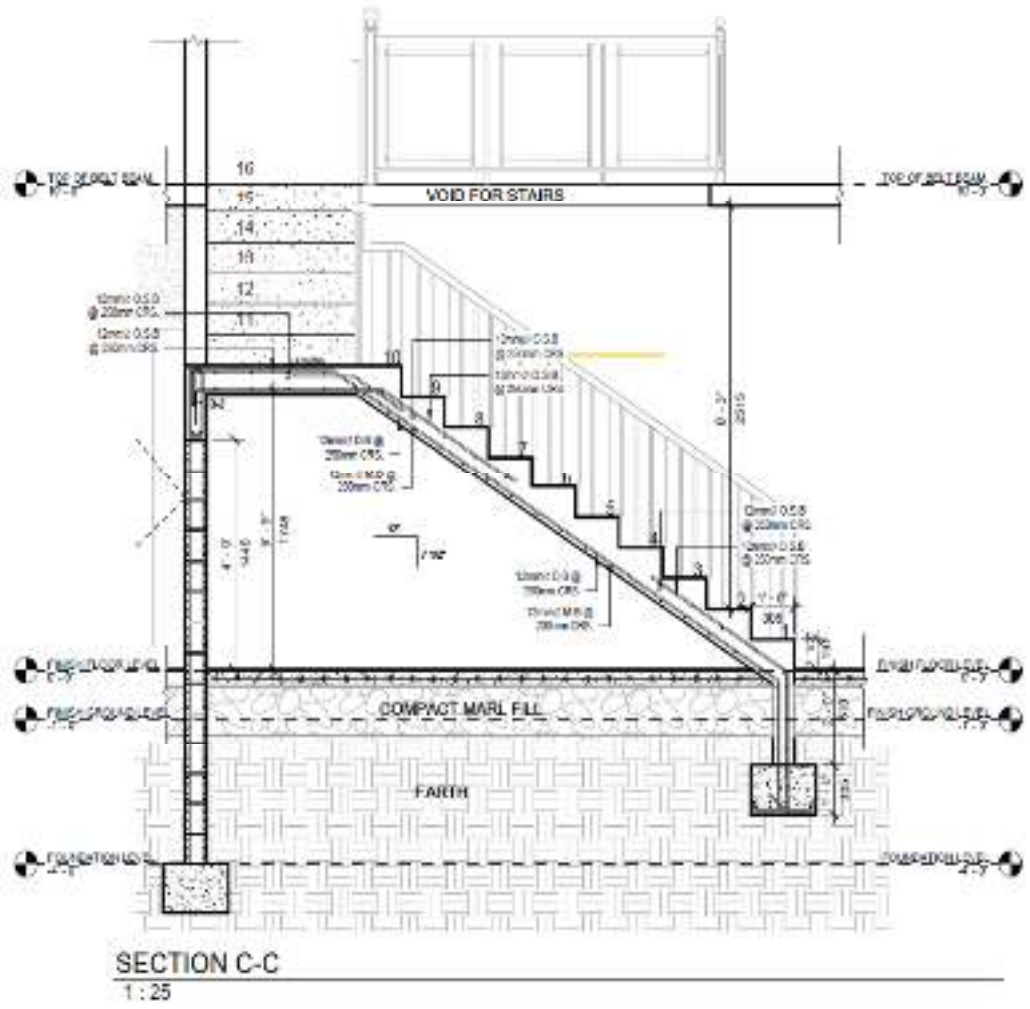
3 marks for complete equation
2 marks for an accurate response

[5 marks]

BUILDING AND MECHANICAL ENGINEERING DRAWING
UNIT 2 — Paper 02
KEY AND MARK SCHEME

Question 1. (continued)

(d) Section C-C to the Scale 1:25



[10 marks]

Total 30 marks

		Criteria	**K**	**A**	**DS**
(a)		Calculating the magnitude of the reactions	1	4	
(b)	(i)	Producing the shear force diagram	1	2	6
	(ii)	Stating the point of zero shear	1		
(c)		Calculating BM max	1	4	
(d)		Drawing Section C-C	1	2	7
			5	**12**	**13**

BUILDING AND MECHANICAL ENGINEERING DRAWING
UNIT 2 — Paper 02
KEY AND MARK SCHEME

MODULE 2

Question 2.

Syllabus reference: 2.2B.1m (i)-(iv), 2.2B.5, 2.2B.2a

(a) (i) The most suitable type of cement that should be used for the Project — Portland Pozzolana Cement (PPC). **[1]**

(ii) Justification for the Response in (a) (i)

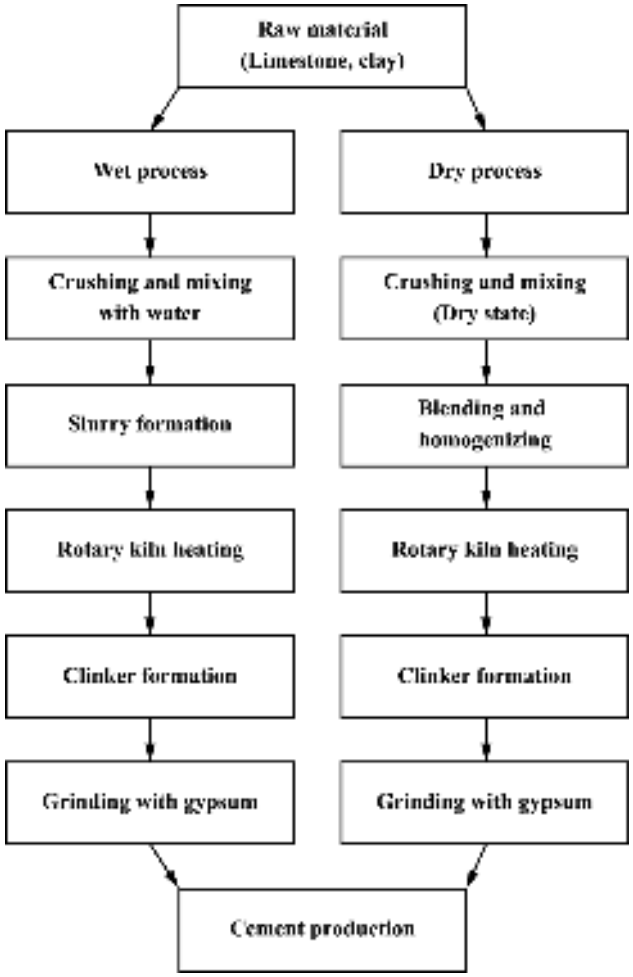
For constructing a small outdoor patio in an area with heavy rainfall, I would choose Portland Pozzolana Cement (PPC) because this type of cement is highly suitable for wet and humid conditions **[1]**, as it has better resistance to moisture and chemicals, particularly sulfates often found in rainwater and soil **[1]**. PPC also has a low heat of hydration, which helps reduce the risk of cracks during curing **[1]**. Additionally, it enhances the durability and longevity of water-exposed structures. Therefore, using PPC would ensure that the patio remains strong and intact over time, despite frequent exposure to rain **[1]**.

[4 marks]

BUILDING AND MECHANICAL ENGINEERING DRAWING
UNIT 2 — Paper 02
KEY AND MARK SCHEME

Question 2. (continued)

(b) Flowchart of Cement Manufacturing Process



1 mark for each correct step under the wet process (up to a maximum of 5 marks)
1 mark for each correct step under the dry process (up to a maximum of 5 marks)

(10 marks)

BUILDING AND MECHANICAL ENGINEERING DRAWING
UNIT 2 — Paper 02
KEY AND MARK SCHEME

Question 2. (continued)

(c) (i) Number of Common Rafters for One Side of the Roof

Given that
a gable roof is being constructed
the length of the roof = 24 feet
the rafter spacing = 16 inches on centre
1 foot = 12 inches → So, 16 inches = 1.33 feet **[2 marks]**

Step 1: Calculate the number of spaces between rafters
To find the number of **spaces** between rafters

- Number of spaces = 24 ft\1.33 ft
- Number of spaces = 18.05

Round down to 18 spaces because we cannot have a partial space.
[3 marks]

Step 2: Determine number of rafters on one side

18 + 1 = 19 rafters **[2 marks]**

(ii) Total Number of Rafters for Both Sides
19 rafters per side × 2 = 38 rafters **[2 marks]**

(d) To manage thermal expansion in concrete and prevent cracking, the following two methods can be employed.

Use of Expansion Joints
Expansion joints are intentional gaps placed at regular intervals in large concrete structures. They allow concrete to expand and contract freely with temperature changes without causing internal stress **(1).** These joints are often filled with flexible materials like rubber or bitumen to absorb movement while keeping out debris and water **(1).**

Proper Curing and Selecting of Materials
Proper curing helps the concrete gain strength gradually and reduces shrinkage cracks **(1).** Additionally, using materials with low thermal expansion coefficients (such as certain aggregates) can help limit expansion and contraction **(1).** This makes the structure more stable under varying temperature conditions.

2 marks for outlining two methods

2 marks for any two points explaining how each helps to prevent damage
[4 marks]

BUILDING AND MECHANICAL ENGINEERING DRAWING
UNIT 2 — Paper 02
KEY AND MARK SCHEME

Question 2. (continued)

		Criteria	**K**	**A**	**DS**
(a)	(i)	Identifying the most suitable type of cement for the project	1		
	(ii)	Justifying the choice based on its properties and performance in wet conditions.		4	
(b)		Drawing the flowchart	2	4	4
(c)	(i)	Calculating the number of common rafters	3	6	
	(ii)	Calculating the total number of rafters	2		
(d)		Outlining two methods that can be used to manage thermal expansion and explaining how they prevent damage	2	2	
			10	**16**	**4**

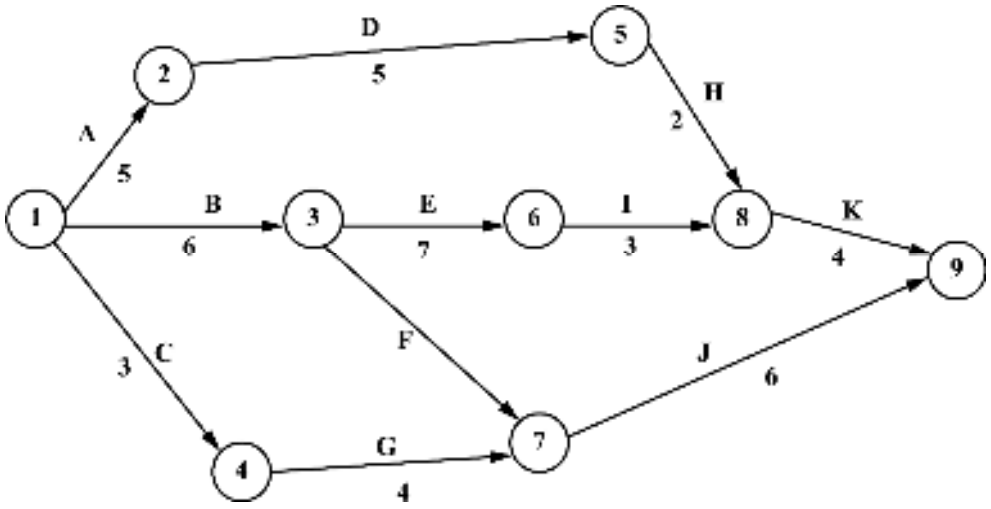
BUILDING AND MECHANICAL ENGINEERING DRAWING
UNIT 2 — Paper 02
KEY AND MARK SCHEME

MODULE 3

Question 3.

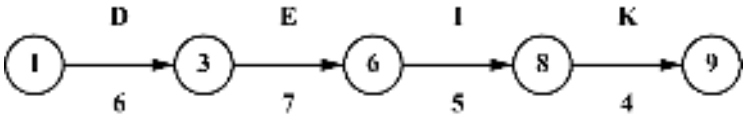
Syllabus reference: 2.3B.1.a,b, 2.3B.2

(a) The Network Diagram



1 mark for each node accurately placed in diagram **[9 marks]**

(ii)



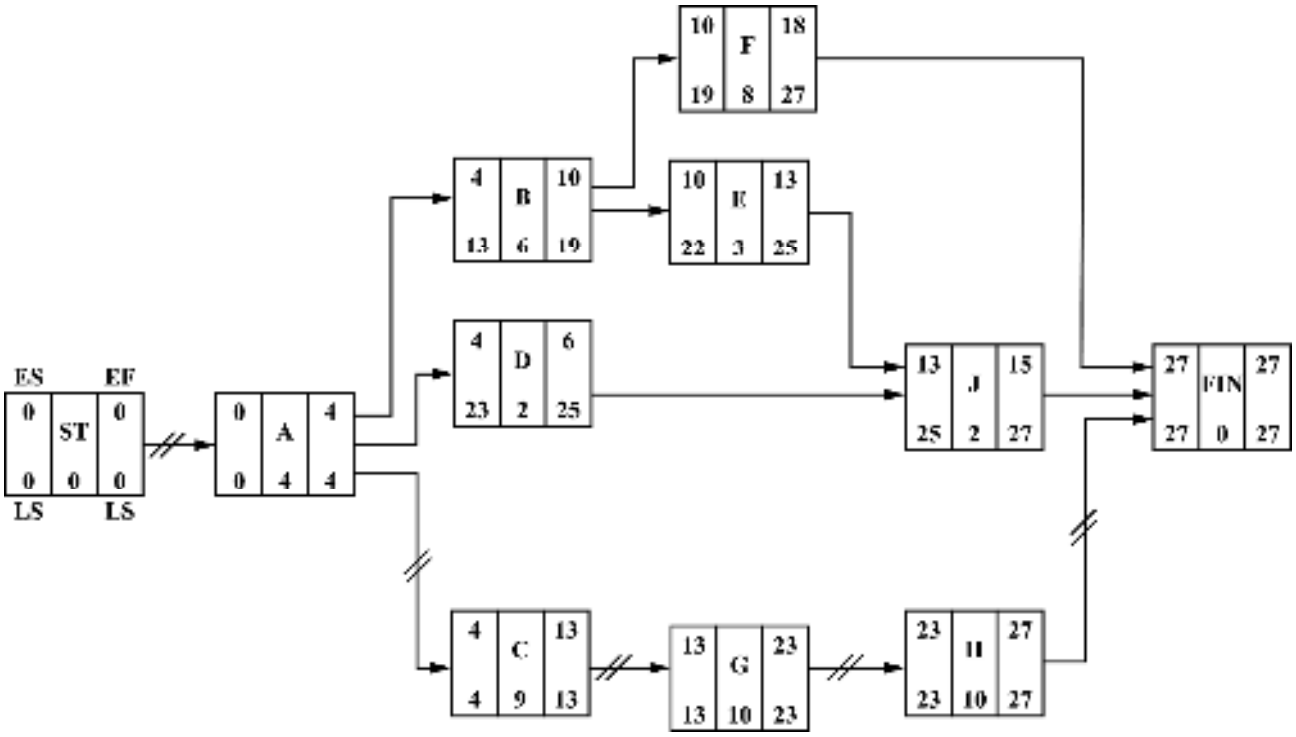
[1 mark]

1 mark for the correct path identified

BUILDING AND MECHANICAL ENGINEERING DRAWING
UNIT 2 — Paper 02
KEY AND MARK SCHEME

Question 3. (continued)

(b) (i) Project Activity Network (using the AON methodology; labelling each node appropriately)



1 mark each for each node accurately placed [11 marks]

(ii) Calculation of the Early Start, Early Finish, Late Start and Late Finish for Each Activity

Activity	Duration	ES	EF	LS	LF
A. Excavation	4	0	4	0	4
B. Reduce level	6	4	10	13	19
C. Pour concrete	9	4	13	4	13
D. Order material	2	4	6	23	25
E. Dam wall	3	10	13	22	25
F. Install pipe	8	10	18	19	27
G. Foundation	10	13	23	13	23
H. Rendering	4	23	27	23	27
I. Painting	2	13	15	25	27

[9 marks]

1 mark for accurate and completed responses for each activity

Total 30 marks

BUILDING AND MECHANICAL ENGINEERING DRAWING
UNIT 2 — Paper 02
KEY AND MARK SCHEME

Question 3. (continued)

		Criteria	**K**	**A**	**DS**
(a)	(i)	Drawing the network diagram	1	6	2
	(ii)	Determining the critical path	1		
(b)	(i)	Constructing the project activity using AON methodology	3	4	4
	(ii)	Calculating ES, EF, LS and LF	1	8	
			6	**18**	**6**

TEST CODE **02168010**

SPECIMEN 2026

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BUILDING AND MECHANICAL ENGINEERING DRAWING

OPTION A — MECHANICAL ENGINEERING DRAWING

UNIT 1 — Paper 01

1 hour 30 minutes

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This test consists of 45 items. You will have 1 hour and 30 minutes to answer them.

2. In addition to this test booklet, you should have an answer sheet.

3. Do not be concerned that the answer sheet provides spaces for more answers than there are items in this test.

4. Each item in this test has four suggested answers lettered (A), (B), (C), (D). Read each item you are about to answer and decide which choice is best.

5. On your answer sheet, find the number which corresponds to your item and shade the space having the same letter as the answer you have chosen. Look at the sample item below.

   Sample Item

   In drawings, thin, short dashes represent

   (A) hidden details
   (B) adjacent parts
   (C) movable parts
   (D) irregular details

   Sample Answer

   ● Ⓑ Ⓒ Ⓓ

   The best answer to this item is "hidden details", so (A) has been shaded.

6. If you want to change your answer, erase it completely before you fill in your new choice.

7. When you are told to begin, turn the page and work as quickly and as carefully as you can. If you cannot answer an item, go on to the next one. You may return to that item later.

8. You may do any rough work in this booklet.

9. Figures are not necessarily drawn to scale.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

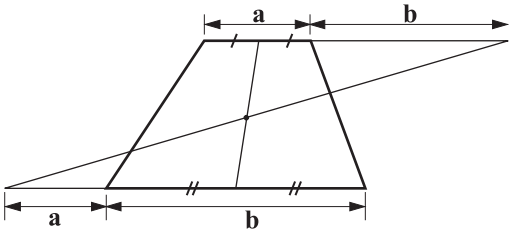
1. Which of the following geometric shapes is obtained by cutting a right cone at an angle to its base?

(A) Circle
(B) Ellipse
(C) Parabola
(D) Hyperbola

2. Which of the following engineering curves may be defined as the locus of a point which moves away from another fixed point at uniform linear velocity and uniform angular velocity?

(A) Involute
(B) Cycloid
(C) Epicycloid
(D) Archimedean spiral

Item **3** refers to the following diagram.



3. The diagram shows how to

(A) find the area of a quadrilateral
(B) determine the perimeter of a trapezium
(C) find the centre of gravity of a trapezium
(D) divide a trapezium into four parts of equal area

4. Which command works on two lines to create a bevelled edge?

(A) Fillet
(B) Extend
(C) Stretch
(D) Chamfer

5. The centroid coincides with the centre of mass or the centre of gravity only if the material of the body is

(A) solid
(B) irregular
(C) symmetrical
(D) homogenous

6. If an area possesses two lines of symmetry, its centroid lies at

(A) the end of each symmetry line

(B) the intersection of the lines of symmetry

(C) $\frac{1}{3}$ from the point of intersection

(D) $\frac{1}{2}$ from the point of intersection

7. The eccentricity of an ellipse is $\frac{3}{5}$. Into how many equal parts is the line joining the directrix to the focus divided when constructing the ellipse using the eccentricity method?

(A) 3
(B) 5
(C) 8
(D) 15

8. In orthographic projection, when a line passes through a plane, the point of intersection is

(A) a trace
(B) oblique projection
(C) first-angle projection
(D) third-angle projection

9. What shape is formed when a plane cuts a cone parallel to the axis?

(A) Circle
(B) Ellipse
(C) Parabola
(D) Hyperbola

10. Which of the following is NOT in the modify toolbar?

(A) Erase
(B) Array
(C) Draw
(D) Offset

11. Which of the following statements are true of first-angle projection?

I. The base represents the horizontal plane onto which is projected the plan.
II. The three sides represent the three vertical planes onto which the front elevation and the two end elevations are projected.
III. The end elevation is in the vertical plane to the plan.

(A) I and II only
(B) I and III only
(C) II and III only
(D) I, II and III

12. Which of the following definitions BEST describes an ellipse?

(A) Locus of a curve that moves around a cylindrical object
(B) Locus of a point on the periphery of a circle which rolls on a straight path
(C) Locus of a point moving such that the ratio of the distances from a fixed point and a fixed line remain constant
(D) Locus of a point moving such that a curve is generated on the periphery of a circle along the foci

13. The moment of inertia is minimum when the axis passes

(A) along the x-axis
(B) through the y-axis
(C) through the centre of the object
(D) through the centroid of the object

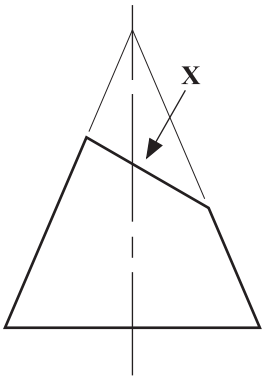
14. Which of the following is the unit for moment of inertia?

(A) m^3
(B) m^4
(C) m^2/sec
(D) m^3/sec

15. The MAIN purpose of using the absolute coordinate method in CAD is to

(A) draw freehand
(B) automate drawing processes
(C) define points using a fixed origin
(D) create objects without reference points

Item **16** refers to the following diagram of a truncated cone.



16. The view taken from the position of Arrow X is an

(A) oblique view
(B) isometric view
(C) auxiliary view
(D) orthographic view

17. A surface of two or more geometric shapes joined together is a

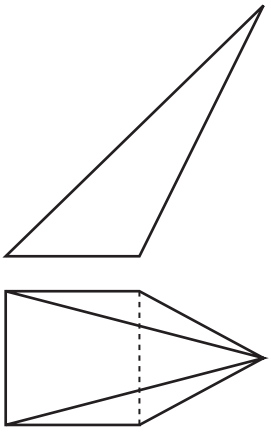
(A) ruled surface
(B) radial surface
(C) parallel surface
(D) composite surface

18. A right circular cone with a base diameter of 80 mm and a slant height of 120 mm is to be developed (unrolled) into a flat pattern.

What would be the sector angle of the resulting development?

(A) 120°
(B) 150°
(C) 180°
(D) 240°

Item **19** refers to the following views of an oblique square pyramid.



19. Which of the following is the MOST suitable method to use when constructing the development of the oblique square pyramid?

(A) Method of arcs
(B) Measuring sides
(C) Transition method
(D) Method of triangulation

20. The **primary** reason for using an auxiliary view is to

(A) locate centre marks
(B) eliminate hidden lines
(C) show cylinders as ellipses and spheres
(D) create a true projection plane from an incline plane

GO ON TO THE NEXT PAGE

21. In the geometric construction of a helix, a cylinder of 60 mm diameter has a helix drawn on its surface with a pitch of 40 mm. The circumference of the cylinder is unrolled into a straight line and set against the pitch height as a right-angled triangle.

What does the hypotenuse of this triangle represent?

(A) True length of one turn
(B) Lead angle of the helix
(C) Thread development
(D) Axis of the cylinder

22. Which orthographic view is needed to produce an auxiliary elevation?

(A) End
(B) Plan
(C) Section
(D) Elevation

23. Which of the following pairs of drawing skills is necessary when drawing the development of a cylinder with an oblique top?

(A) Plan and section
(B) Plan and elevation
(C) Elevation and section
(D) Elevation and end elevation

24. A hexagonal pyramid that does NOT have its apex directly above the centre of its base is described as

(A) a regular pyramid
(B) a frustum pyramid
(C) an oblique pyramid
(D) a truncated pyramid

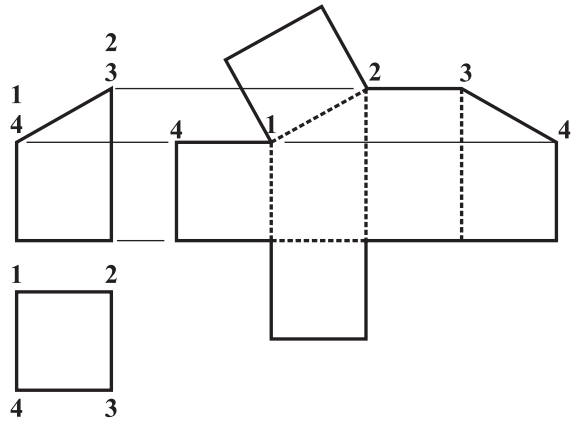
25. In isometric projection, the four-centre method is used to construct

(A) an ellipse
(B) a square
(C) a triangle
(D) a rectangle

26. In order to classify a pictorial drawing as an isometric projection, the isometric axes MUST be

(A) 30° apart
(B) 45° apart
(C) 60° apart
(D) 120° apart

Items **27** and **28** refer to the following diagram.



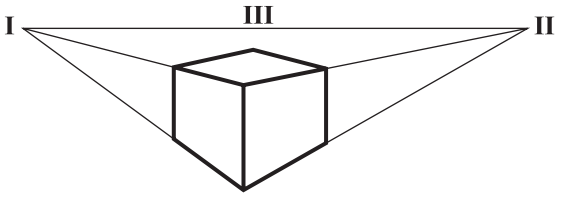
27. The development in the diagram shows a

(A) square prism with a square top
(B) pyramid with a rectangular top
(C) square prism with an oblique top
(D) hexagonal prism with a square top

28. What do the dotted lines in the development represent?

(A) Width
(B) Corners
(C) Cutting line
(D) Drawing line

Item **29** refers to the following pictorial diagram of a box.



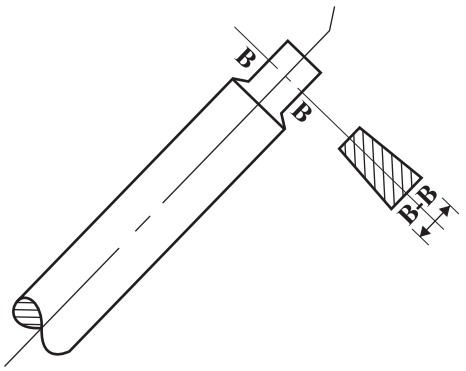
29. What type of projection was used to draw the box?

(A) Oblique
(B) Isometric
(C) Perspective
(D) Planometric

30. The line of intersection is a curve when the two solids are a

(A) cube and a prism
(B) cone and a cylinder
(C) cube and a pyramid
(D) pyramid and a cuboid

Item **31** refers to the following diagram.



31. What type of sectioning is shown in the diagram?

(A) Half section
(B) Aligned section
(C) Revolved section
(D) Removed section

32. The distance that a follower moves in one revolution while in contact with a cam is called

(A) fall
(B) rise
(C) dwell
(D) displacement

33. Hatching lines are used for

(A) displaying internal components
(B) displaying sawtooth lines
(C) identifying machine parts
(D) showing cut-off sections

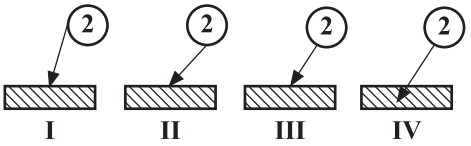
34. A cam creates linear motion from

(A) forces
(B) rotary motion
(C) kinetic energy
(D) potential energy

35. Which of the following items are sectioned?

(A) Keys
(B) Shafts
(C) Pulleys
(D) Nuts and bolts

Item **36** refers to the following diagram showing an item listing via balloon-referencing.



36. Which of the balloon references is correct?

(A) I
(B) II
(C) III
(D) IV

37. Which of the following is NOT part of an items (parts) listing?

(A) MATL.
(B) No. OFF
(C) REMARKS
(D) TOLERANCE

38. Which type of fastener is typically used to prevent motion between a shaft and a hub?

(A) Key
(B) Bolt
(C) Screw
(D) Washer

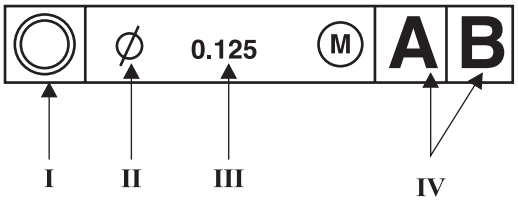
39. In a centrifugal pump, fluid is moved via a

(A) piston
(B) plunger
(C) diaphragm
(D) rotary impeller

40. A static seal is used when

(A) there is no pressure
(B) high-speed rotation occurs
(C) parts are in relative motion
(D) parts are stationary relative to each other

Items **41**–**43** refer to the following diagram showing dimension elements.



41. Which element is denoted by the arrow labelled III?

(A) Tolerance value
(B) Optional diameter
(C) Geometric condition
(D) Material condition of tolerance

42. Which element is denoted by the arrow labelled IV?

(A) Geometric condition
(B) Optional diameter
(C) Tolerance value
(D) Datum

43. Which element represents concentric circles?

(A) I
(B) II
(C) III
(D) IV

44. Which of the following is a disadvantage of the knife-edge follower?

(A) It wears faster.
(B) It slows down the cam.
(C) It is difficult to construct.
(D) It has the ability to move around the cam easily.

45. Which of the following valves is MOST suitable for allowing flow in one direction, uses pressure and velocity to flow, and cannot be controlled from an external source?

(A) Ball
(B) Gate
(C) Globe
(D) Non-return

END OF TEST

C A R I B B E A N E X A M I N A T I O N S C O U N C I L

CARIBBEAN ADVANCED PROFICIENCY EXAMINATION

BUILDING AND MECHANICAL ENGINEERING DRAWING

OPTION A – MECHANICAL ENGINEERING DRAWING

UNIT 1

SPECIMEN PAPER 2026

Item No.	Key	Specific Objective
1	B	1:1:3a
2	D	1:1:3a
3	C	1:1:2
4	D	1:1:1c
5	D	1:1:4
6	B	1:1:4
7	C	1:1:3a
8	A	1:1:6
9	D	1:1:3a
10	C	1:1:1c
11	B	1:1:6a
12	C	1:1:3a
13	D	1:1:5a
14	B	1:1:5a
15	C	1:1:1
16	C	1:2:2a
17	D	1:2:4b
18	A	1:2:4a
19	D	1:2:4a
20	D	1:2:2
21	A	1:2:5
22	B	1:2:2c
23	B	1:2:4a

Item No.	Key	Specific Objective
24	C	1:2:4a
25	A	1:2:1b
26	D	1:2:1a
27	C	1:2:4a
28	B	1:2:4a
29	C	1:2:1 a
30	B	1:2:3
31	D	1:3A:2a
32	D	1:3A:4a
33	A	1:3A:2a
34	B	1:3A:4
35	C	1:3A:3a
36	C	1:3A:3a
37	D	1:3A:5 d
38	A	1:3A:6
39	D	1:3A:6
40	D	1:3A:6
41	A	1:3A:5
42	D	1:3A:5
43	A	1:3A:5
44	A	1:3A:4b
45	D	1:3A:6 f

CARIBBEAN EXAMINATIONS COUNCIL

BUILDING AND MECHANICAL ENGINEERING DRAWING

OPTION A – MECHANICAL DRAWING

UNIT 01– PAPER 02

TABLE OF SPECIFICATIONS

SPECIMEN

Module	Content	Item No.	Objectives	Profiles and Marks			Total
				Knowledge	Application	Drawing Skills	
1	Standard Geometrical Curves	**1(a)**	1.1.3(a) &(b)	3	3	4	10
	Orthographic Projection	**1(b)**	1.1.6(a)	5	7	8	20
Subtotal				**8**	**10**	**12**	**30**
2	Pictorial Projections	**2(a)**	1.2.1(a)	3	3	4	10
	Intersection and interpenetration of solids such as spheres, cones, cylinders, pyramids and prisms.	**2(b) (i)-(iv)**	1.2.3 1.2.4(a)	4	8	8	20
Subtotal				**7**	**11**	**12**	**30**

Module	Content	Item No.	Objectives	Profiles and Marks			Total
				Knowledge	Application	Drawing Skills	
3	Displacement Diagrams for CAM	**3(a) (i) –(ii)**	1.3A.4(a) &(b)	4	4	6	14
	Drawings with Sectional Views	**3(b)(i) – (v)**	1.3A.2(a)	5	5	6	16
Subtotal				**9**	**9**	**12**	**30**
Total				**24**	**30**	**36**	**90**

TEST CODE **02168020**

SPECIMEN 2026

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BUILDING AND MECHANICAL ENGINEERING DRAWING

OPTION A — MECHANICAL ENGINEERING DRAWING

UNIT 1 — Paper 02

2 hours 30 minutes

GENERAL INFORMATION

1. This paper consists of THREE questions in THREE sections.. Answer ALL questions.
2. Silent, non-programmable calculators may be used for this examination.
3. For this examination, each candidate should have the following.

   A minimum of six sheets of 11" × 17" paper
   Personal computer with monitor, keyboard, mouse and printer
   Computer-aided drafting software

   NOTE: After completing EACH question, save your work electronically as a pdf file on the available storage device. At the conclusion of the examination, the invigilator will give you instructions for submitting the saved files for printing. All work MUST be printed for submission.

INSTRUCTIONS TO CANDIDATES

1. All dimensions given are in millimetres unless otherwise stated.
2. Where scales are not stated, the full size should be applied.
3. All geometrical construction lines MUST be visible on all drawings.
4. When first-angle or third-angle is not specified, the choice of projection is left to the candidate's discretion, in which case the type of projection used MUST be clearly stated.
5. The candidate should use his/her own judgement to supply any dimensions or other details not directly shown on the drawings.
6. The number of each question MUST be written next to the solution.
7. Each candidate MUST enter his/her school code and registration number in the appropriate space at the bottom of the drawing paper.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

SECTION A

MODULE 1 — GEOMETRY 1

Answer the question in this section.

1. (a) (i) Using the focal point method, construct an ellipse given that the major axis is 98 mm and the distance between the focal points is 70 mm. **[5 marks]**

(ii) Construct a normal and a tangent to a Point, P, on the curve of the ellipse located in the top left-hand quadrant. **[4 marks]**

(iii) State the length of the minor axis. **[1 mark]**

(b) Figure 1 shows a pictorial projection of a sliding tool with the front view identified by Arrow X.

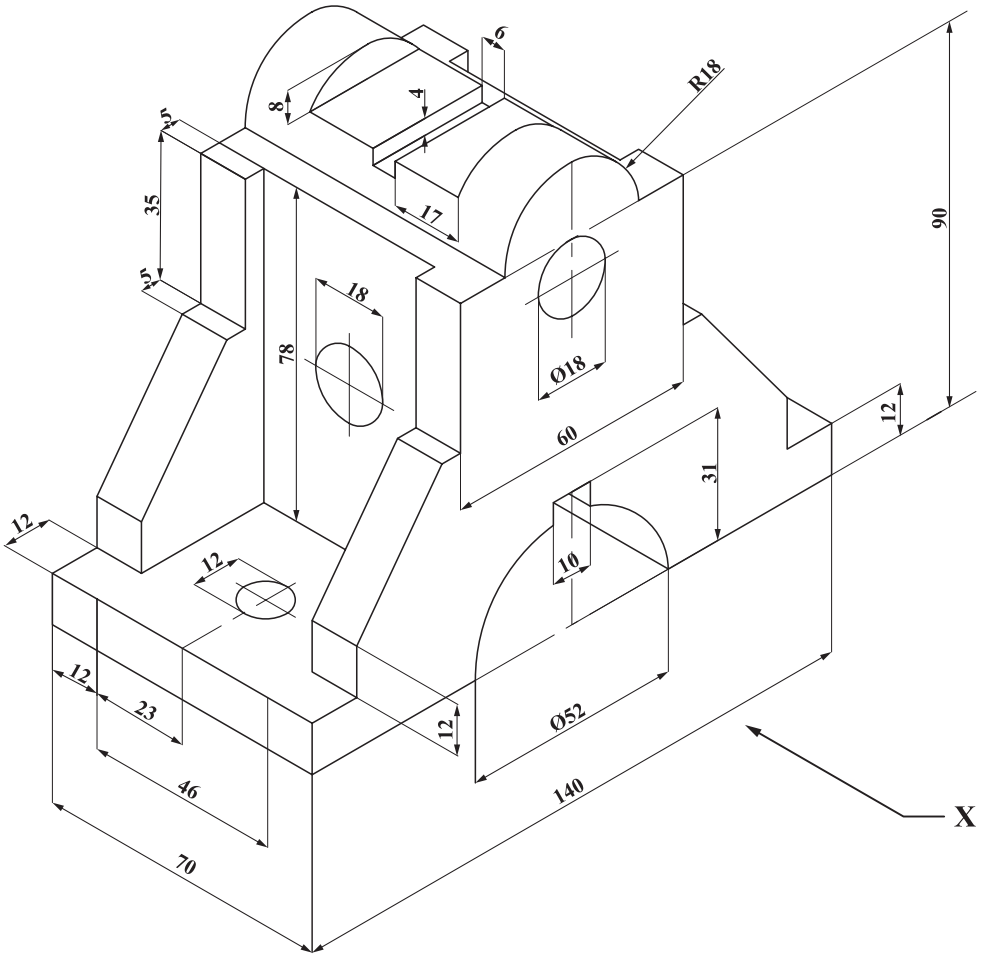


Figure 1. Sliding tool

(i) Using the given dimensions, draw EACH of the following views in first-angle orthographic projection

a) the front elevation **[5 marks]**

b) the plan view **[5 marks]**

c) the end elevation as seen from the right side **[5 marks]**

(ii) Label and show EIGHT dimensions. **[4 marks]**

(iii) Identify the projection used by the symbol. **[1 mark]**

Total 30 marks

SECTION B

MODULE 2 — GEOMETRY 2

Answer the question in this section.

2. (a) Figure 2 shows a bearing support drawn in third-angle orthographic projection.

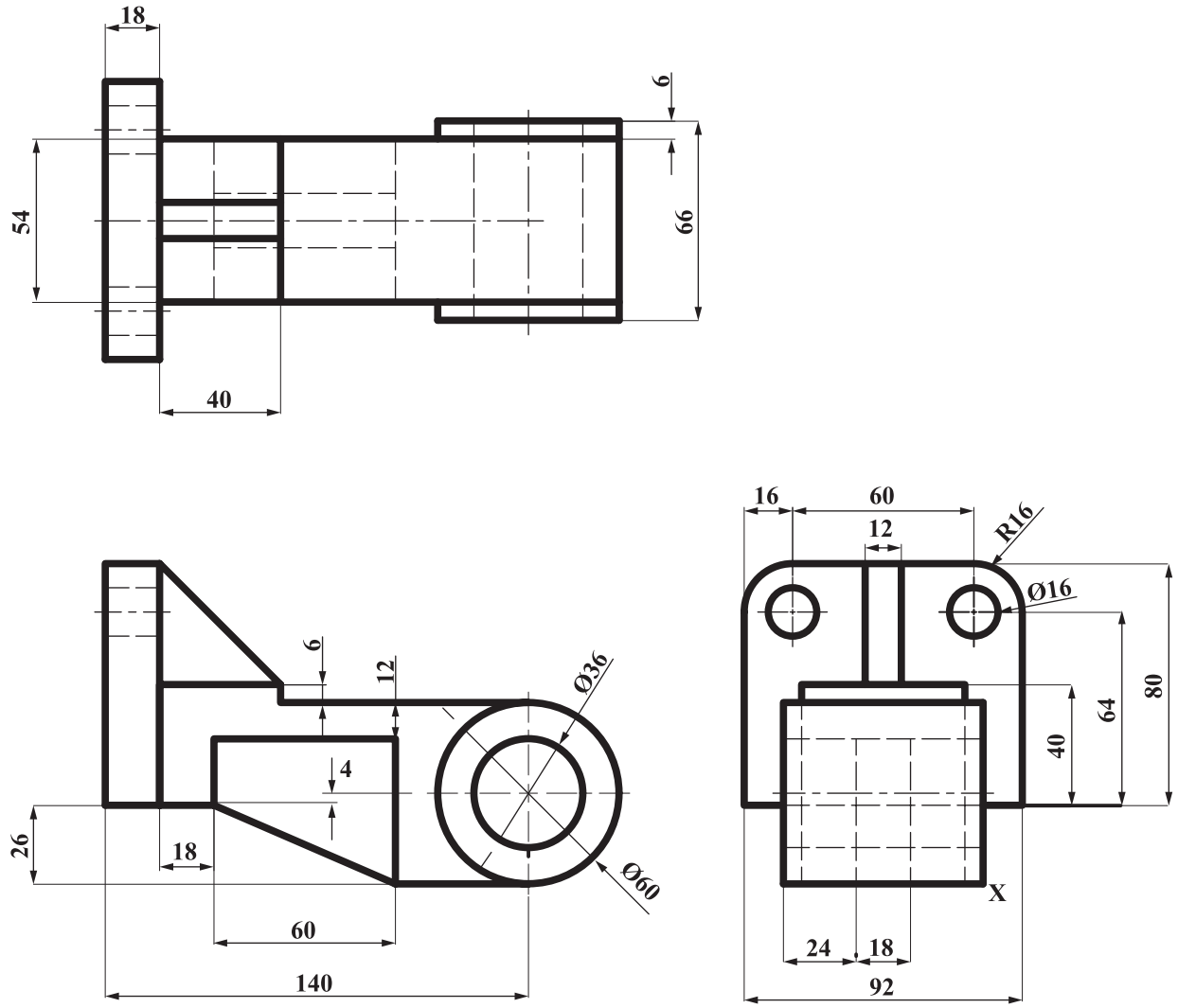


Figure 2. Bearing support

Using the given dimensions, draw the isometric projection. Ensure that Point X is the lowest point. **[10 marks]**

(b) Figure 3 is a partially completed orthographic drawing showing the joining of a hexagonal prism onto a square-based prism.

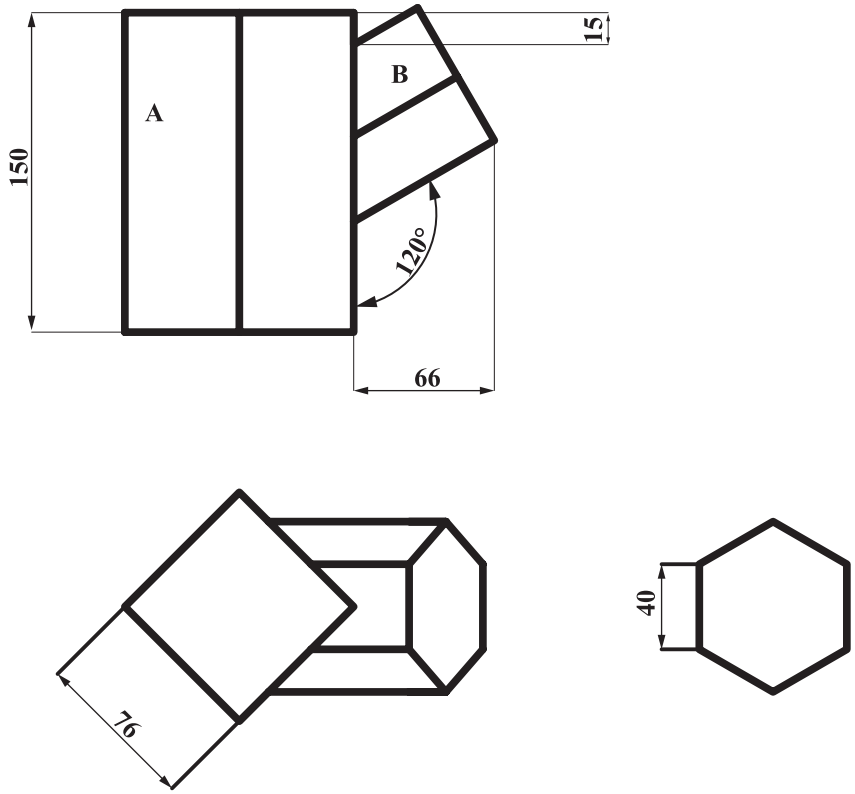


Figure 3. Partially completed orthographic drawing

Using a suitable scale, produce EACH of the following.

(i) The completed diagram, showing the lines of interpenetration when Shape A is interpenetrated by Shape B **[10 marks]**

(ii) The development of Shape A **[5 marks]**

(iii) The development of Shape B **[5 marks]**

Total 30 marks

NOTHING HAS BEEN OMITTED.

SECTION C

MODULE 3A — ENGINEERING DRAWING

Answer the question in this section.

3. (a) The following data represents the specification of a plate cam rotating in a clockwise direction.

Specifications

– Cam shaft diameter – 30 mm diameter
– Least radius of cam – 35 mm
– Follower type – inline roller of 20 mm diameter

– 0° – 90° rise 30 mm with uniform velocity
– 90° – 150° rise 30 mm with simple harmonic motion
– 150° – 210° dwell
– 210° – 360° fall 60 mm with uniform acceleration and retardation

(i) Draw the cam displacement diagram using a suitable scale. **[7 marks]**

(ii) Draw the cam profile. **[7 marks]**

(b) Figure 4 shows the pictorial view of a bearing bracket with the front view identified by the arrow A.

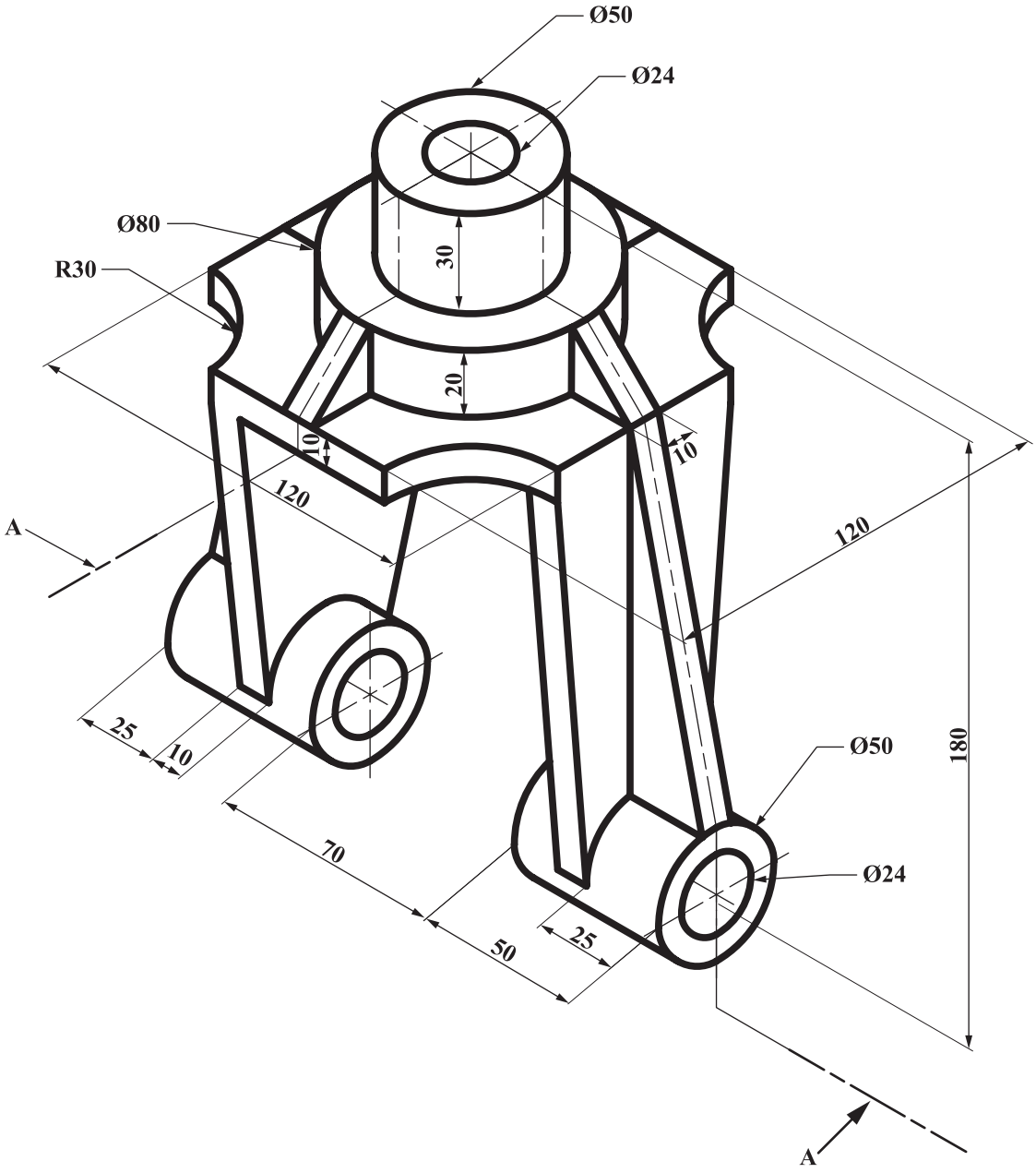


Figure 4. Bearing bracket

(i) Using the given dimensions, draw EACH of the following in first-angle orthographic projection.

a) A half-sectional front elevation in the direction of Arrow A **[6 marks]**

b) A complete plan **[5 marks]**

(ii) Show SIX important dimensions and label the drawings. **[4 marks]**

(iii) Identify, by means of the symbol, the projection used. **[1 mark]**

Total 30 marks

END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.

C A R I B B E A N E X A M I N A T I O N S C O U N C I L

CARIBBEAN ADVANCED PROFICIENCY EXAMINATION®

BUILDING AND MECHANICAL ENGINEERING DRAWING

OPTION A – MECHANICAL ENGINEERING DRAWING

UNIT 1 — Paper 02

KEY AND MARK SCHEME

SPECIMEN 2026

BUILDING AND MECHANICAL ENGINEERING

UNIT 1 — Paper 02

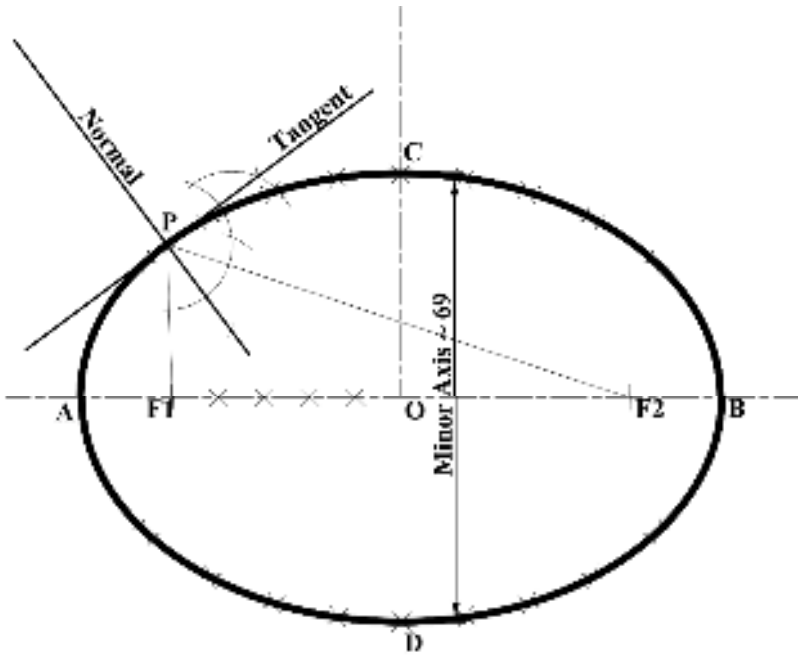
KEY AND MARK SCHEME

MODULE 1

Question 1.

Syllabus ref: 1.1.3(a)&(b), 1.1.6(a)

(a)(i) – (iii)



9 marks for accurately drawing an ellipse with normal and tangent
1 mark for accurately stating the length of the minor axis — 69 mm

[10 marks]

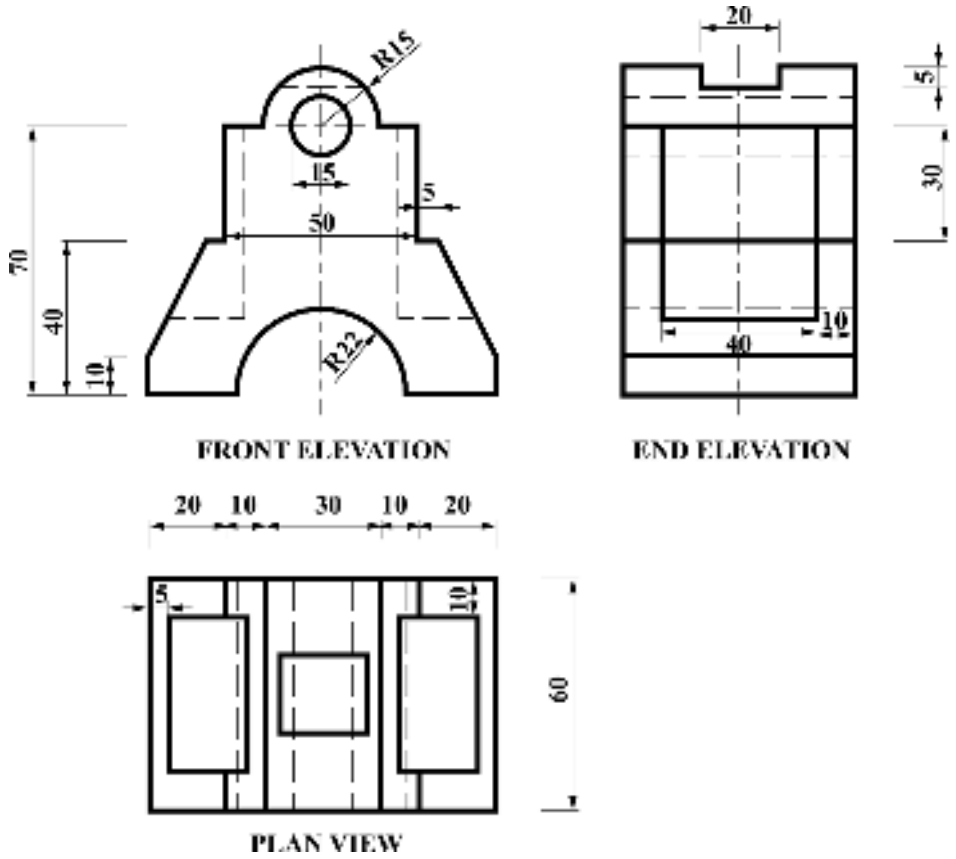
BUILDING AND MECHANICAL ENGINEERING

UNIT 1 — Paper 02

KEY AND MARK SCHEME

Question 1. (continued)

(b) (i) – (v)



5 marks for each diagram correctly drawn (up to a maximum of 15 marks)
4 marks for any eight dimensions labelled
1 mark for the projection symbol clearly shown

[20 marks]

Total 30 marks

BUILDING AND MECHANICAL ENGINEERING

UNIT 1 — Paper 02

KEY AND MARK SCHEME

Question 1. (continued)

		Criteria	**K**	**A**	**DS**
(a)	(i)	Drawing the ellipse	1	2	2
	(ii)	Drawing the normal and tangent	1	1	2
	(iii)	Stating the length of the minor axis	1		
(b)	(i)(a)	Drawing the front elevation	1	2	2
	(b)	Drawing the plan view	1	2	2
	(c)	Drawing the end elevation	1	2	2
	(ii)	Labelling and showing the dimensions	1	1	2
	(iii)	Showing the projection symbol	1		
			8	**10**	**12**

BUILDING AND MECHANICAL ENGINEERING

UNIT 1 — Paper 02

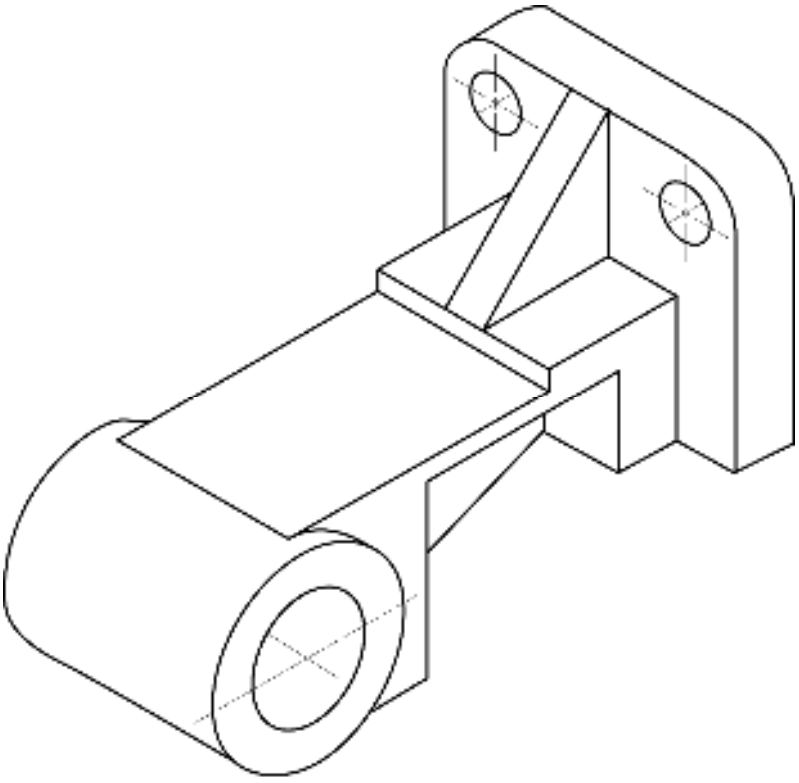
KEY AND MARK SCHEME

MODULE 2

Question 2.

Syllabus ref: 1.2.1(a)(iii), 1:2:3, 1:2:4(a)

(a)



9 marks for the completed drawing showing curves and circles
1 mark for showing Position X

[10 marks]

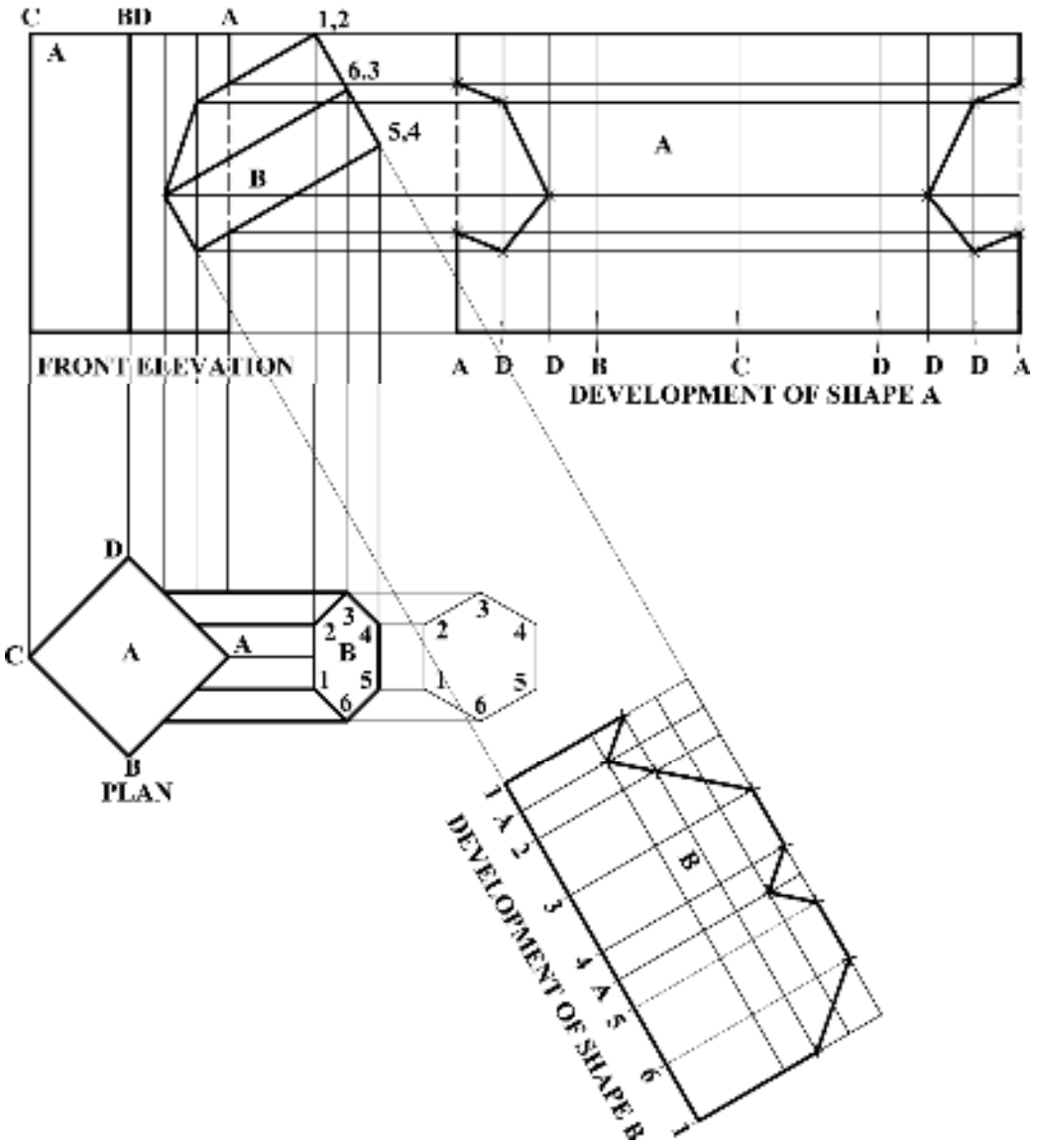
BUILDING AND MECHANICAL ENGINEERING

UNIT 1 — Paper 02

KEY AND MARK SCHEME

Question 2. (continued)

(b) (i), (ii) & (ii)



10 marks for the completed diagram
5 marks for the development of Shape A
5 marks for the development of Shape B

[20 marks]
Total 30 marks

Question 2. (continued)

		Criteria	**K**	**A**	**DS**
(a)		Drawing the isometric layout	1	1	2
		Drawing the isometric curves and circles	1	2	2
		Positioning X correctly	1		
(b)	(i)	Drawing the given diagram	1	2	2
		Drawing the lines of intersection	1	2	2
	(ii)	Drawing the development of A	1	2	2
	(iii)	Drawing the development of B	1	2	2
			7	**11**	**12**

BUILDING AND MECHANICAL ENGINEERING

UNIT 1 — Paper 02

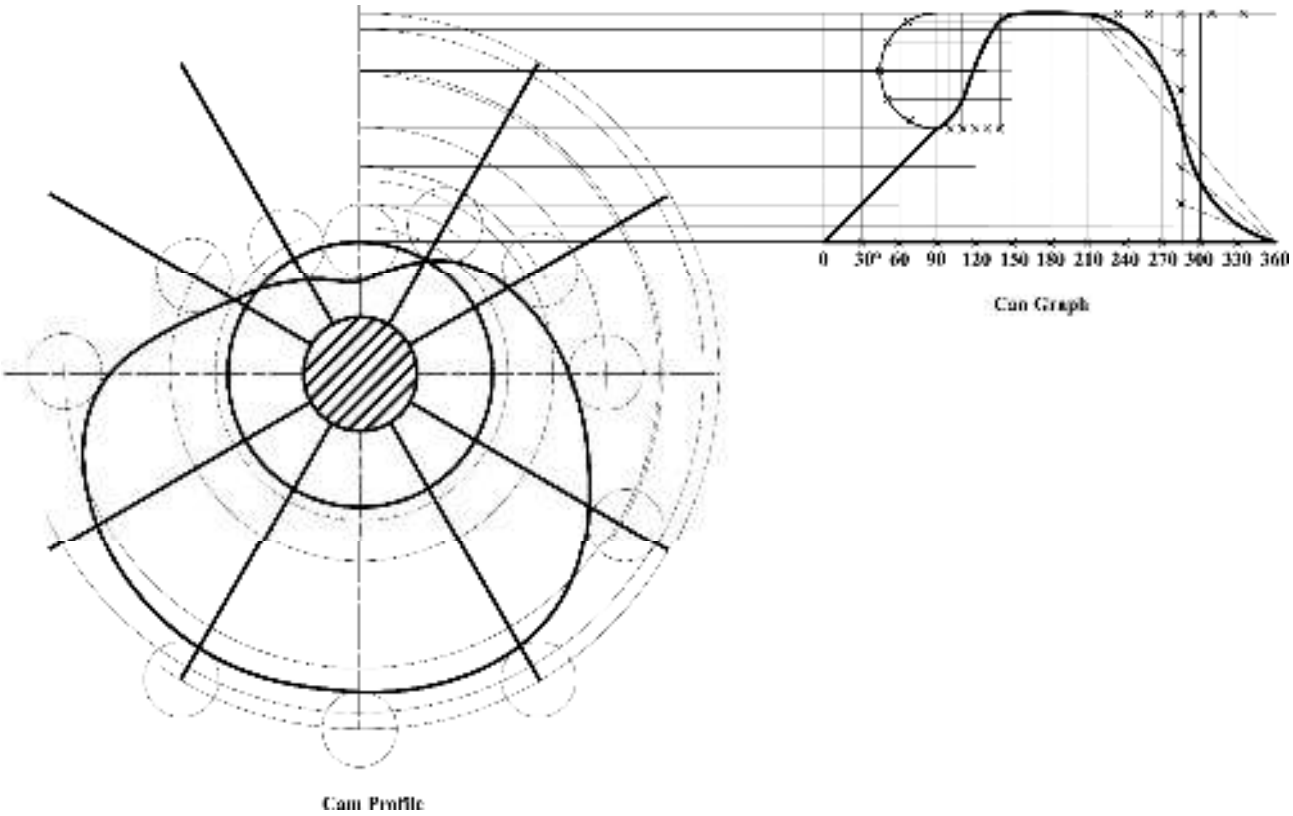
KEY AND MARK SCHEME

MODULE 3

Question 3.

Syllabus ref:1:3A:4(a)&(b), 1:3A:2(a)

(a)(i) – (ii)

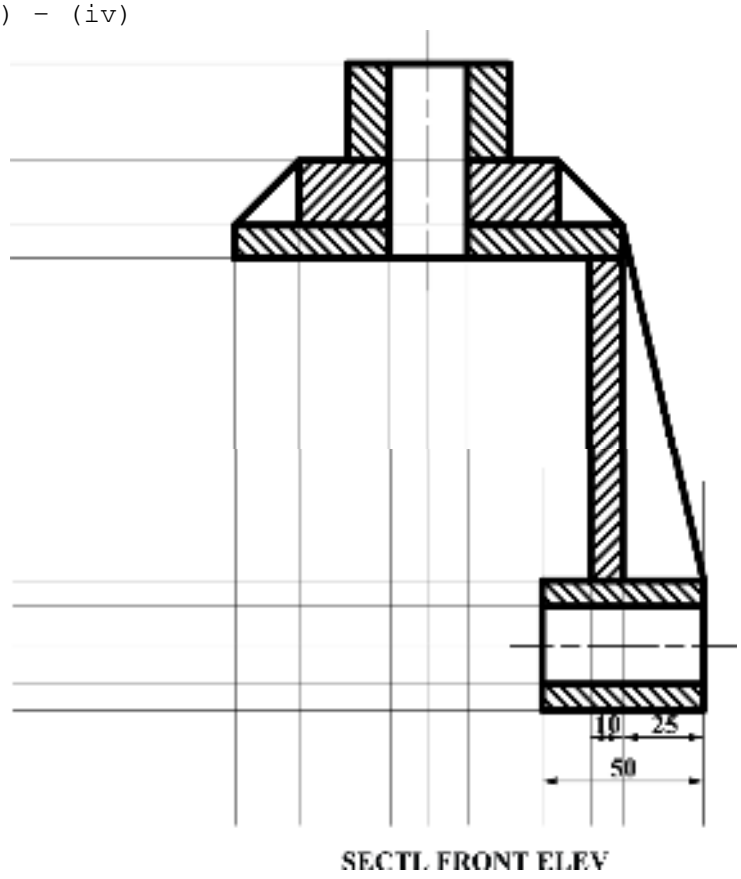


7 marks for the cam profile
7 marks for the cam graph

[14 marks]

Question 3. (continued)

(b)(i) – (iv)

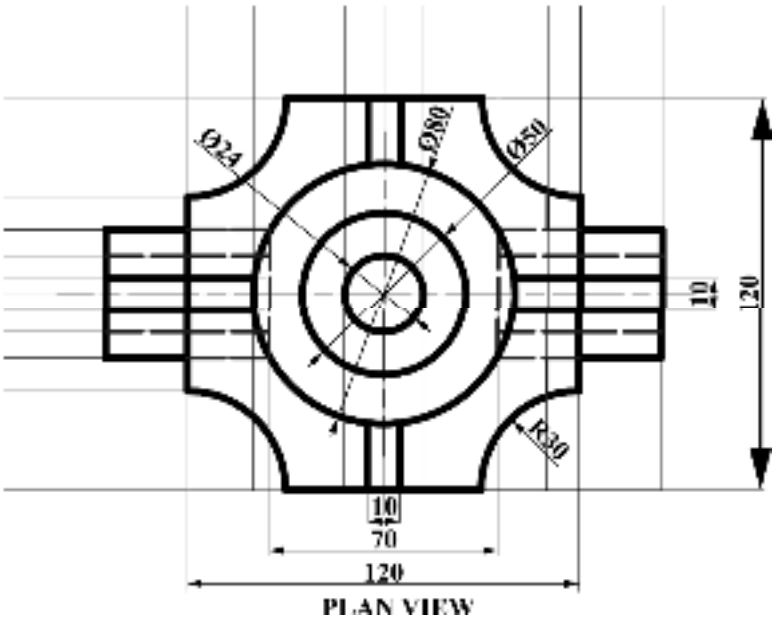


6 marks for the front elevation drawing

BUILDING AND MECHANICAL ENGINEERING

UNIT 1 — Paper 02

KEY AND MARK SCHEME



5 marks for the plan view drawing

4 marks for accurate dimensioning and complete labelling

(2 marks if dimensioning is inaccurate and labelling is incomplete)

1 mark for the projection symbol

[16 marks]

Total 30 marks

		Criteria	**K**	**A**	**DS**
(a)	(i)	Cam displacement diagram	2	2	3
	(ii)	Cam profile	2	2	3
(b)	(i)	Drawing a half-sectional elevation	2	2	2
	(ii)	Drawing a complete plan	1	2	2
	(iii)	Showing the dimensions and labelling the drawings	1	1	2
	(iv)	Showing the projection symbol	1		
			9	**9**	**12**

TEST CODE **02268010**

SPECIMEN 2026

CARIBBEAN EXAMINATIONS COUNCIL

CARIBBEAN ADVANCED PROFICIENCY EXAMINATION®

BUILDING AND MECHANICAL ENGINEERING DRAWING

OPTION A — MECHANICAL ENGINEERING DRAWING AND DESIGN

UNIT 2 — Paper 01

1 hour 30 minutes

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This test consists of 45 items. You will have 1 hour and 30 minutes to answer them.
2. In addition to this test booklet, you should have an answer sheet.
3. Do not be concerned that the answer sheet provides spaces for more answers than there are items in this test.
4. Each item in this test has four suggested answers lettered (A), (B), (C), (D). Read each item you are about to answer and decide which choice is best.
5. On your answer sheet, find the number which corresponds to your item and shade the space having the same letter as the answer you have chosen. Look at the sample item below.

   Sample Item

   Which of the following is NOT a stage of the design process?

   (A) Synthesis
   (B) Evaluation
   (C) Presentation
   (D) Coordination

   Sample Answer

   The best answer to this item is "Coordination", so (D) has been shaded.
6. If you want to change your answer, erase it completely before you fill in your new choice.
7. When you are told to begin, turn the page and work as quickly and as carefully as you can. If you cannot answer an item, go on to the next one. You may return to that item later.
8. You may do any rough work in this booklet.
9. Figures are not necessarily drawn to scale.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

1. Which of the following formulas is used to calculate the circular pitch (*C.P.*) for an involute spur gear?

(A) $C.P. = \frac{PCD \times \pi}{T}$

(B) $C.P. = \frac{m \times \pi}{PCD}$

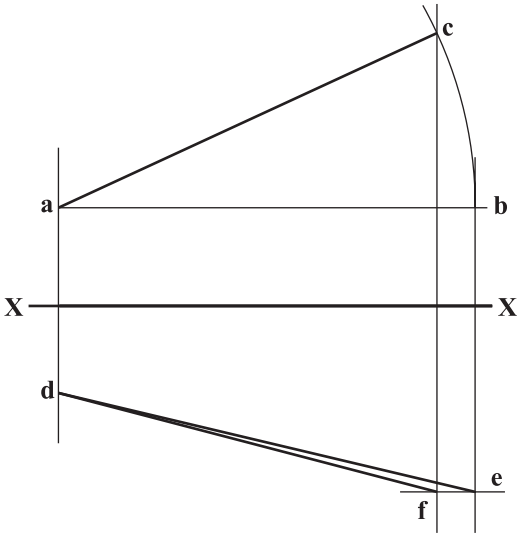
(C) $C.P. = \frac{m \times \pi}{PCD}$

(D) $C.P. = \frac{PCD}{T \times \text{m}}$

2. What is the pitch circle diameter of an involute spur gear, given that the metric module (m) = 10 and the number of teeth (T) = 25?

(A) 50 mm
(B) 125 mm
(C) 250 mm
(D) 350 mm

Items **3–5** refer to the following diagram which shows an orthographic view of a skew line.



3. Which of these lines are projections of the original line in space?

(A) a-c, d-f
(B) a-b, d-e
(C) a-c, a-b
(D) d-f, d-e

4. Which line is the true length?

(A) a-b
(B) a-c
(C) d-e
(D) d-f

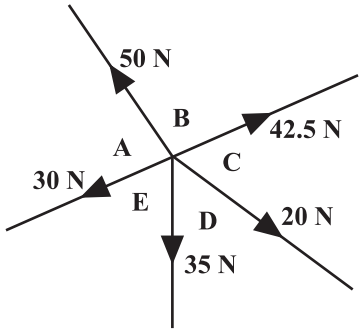
5. In which plane is figure abc located?

(A) Vertical
(B) Auxiliary
(C) Horizontal
(D) True length

6. Which of the following represents the shortest distance between two skew lines?

(A) Common perpendicular
(B) Horizontal projection
(C) Auxiliary projection
(D) Vertical trace

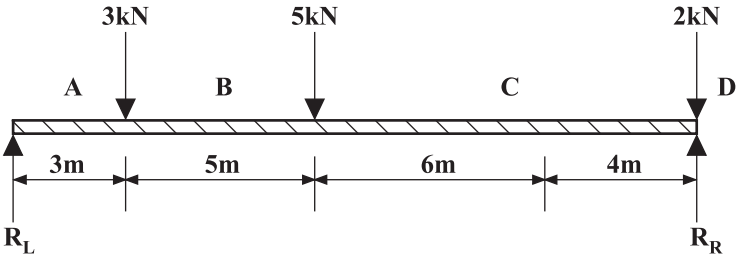
Item **7** refers to the following diagram of a system of forces.



7. From a visual inspection of the diagram, which of the following statements is true?

(A) The system is in equilibrium.
(B) The resultant of the system is 177.5 N.
(C) Force AB has no vertical component.
(D) Force ED has no horizontal component.

Items **8** and **9** refer to the following diagram which shows forces acting on a beam.



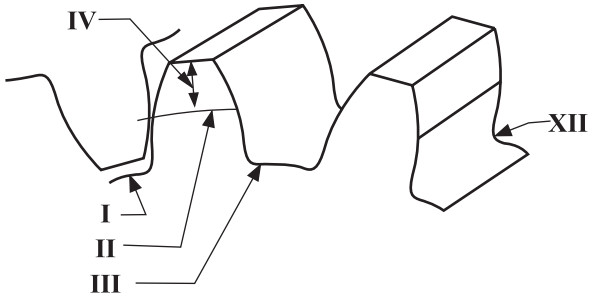
8. Which of the following is the resultant of R_L?

(A) 4.72 kN
(B) 5.27 kN
(C) 7.0 kN
(D) 8.0 kN

9. Which of the following is the resultant of R_R?

(A) 4.27 kN
(B) 5.27 kN
(C) 7.0 kN
(D) 8.0 kN

Items **10–12** refer to the following diagram which shows part of an involute spur gear.



10. Which label identifies the dedendum?

(A) II
(B) III
(C) IV
(D) XII

11. Which label identifies the addendum?

(A) II
(B) III
(C) IV
(D) XII

12. Label I identifies the

(A) flank
(B) clearance
(C) pitch circle
(D) space width

13. When the net resultant of opposing forces on a beam is zero, the forces are said to be

(A) static
(B) linked
(C) in alignment
(D) in equilibrium

14. Which force member refers to a single truss segment that is neither in tension nor compression?

(A) Concurrent
(B) Coplanar
(C) True
(D) Zero

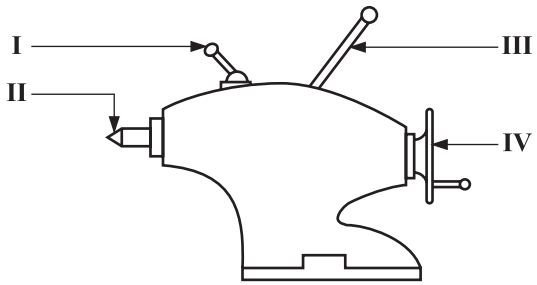
15. Which of the following parameters of an involute spur gear is equal to the diameter of the pitch circle when divided by the number of teeth?

(A) Module
(B) Circular pitch
(C) Diametrical pitch
(D) Base circle diameter

16. Which of the following nonmetallic materials is capable of being formed or molded with the aid of heat, pressure, chemical reactions, or a combination of these?

(A) Glass
(B) Metal
(C) Plastic
(D) Rubber

Items **17–19** refer to the following diagram showing a component of a lathe with several labelled parts.



17. What is the name of the component illustrated in the diagram?

(A) Toolpost
(B) Tailstock
(C) Headstock
(D) Compound slid

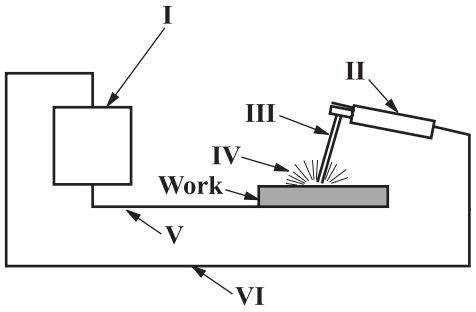
18. Which of the labelled parts is used for supporting a workpiece between centres?

(A) I
(B) II
(C) III
(D) IV

19. Which of the labelled parts is responsible for the advancing and retracting of the sleeve?

(A) I
(B) II
(C) III
(D) IV

Items **20–22** refer to the following line diagram of an arc welding setup with labelled components.



20. Which of the labelled Arrows denotes the electrode holder?

(A) I
(B) II
(C) III
(D) IV

21. Which feature of the setup does Arrow VI represent?

(A) Arc wire
(B) Electrode arc
(C) Electrode cable
(D) Worktable cable

22. Which of the labelled arrows identifies the electrode?

(A) I
(B) II
(C) III
(D) IV

Items **23** and **24** refer to the following properties of materials.

I. Toughness
II. Ductility
III. Malleability
IV. Hardness

23. Which property is essential for materials that are to be used to make wires?

(A) I
(B) II
(C) III
(D) IV

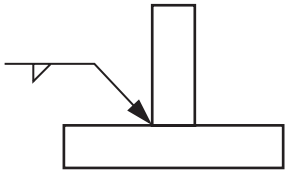
24. Which property gives a material the ability to resist scratches?

(A) I
(B) II
(C) III
(D) IV

25. Which of the following casting processes is MOST suitable for the mass production of aluminum components?

(A) Net casting
(B) Die casting
(C) Sand casting
(D) Investment casting

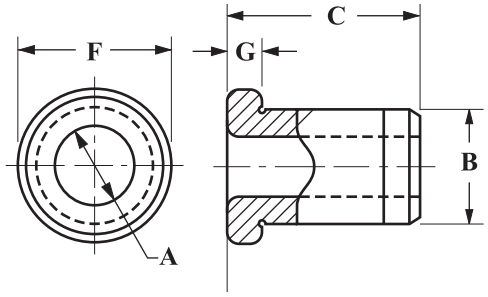
Item **26** refers to the following diagram of a welding symbol.



26. What information is being communicated on the diagram?

(A) Fillet weld, arrow side
(B) Fillet weld, other side
(C) Groove weld, both sides
(D) Groove weld, underside

Items **27** and **28** refer to the following diagram which shows a typical drill bushing.



27. Which of the following is the BEST fit for the outside dimension of the bushing?

(A) $\frac{H9}{e9}$

(B) $\frac{H7}{h6}$

(C) $\frac{H7}{k6}$

(D) $\frac{H7}{p6}$

28. Which of the following is the BEST fit for the inside dimension of the bushing?

(A) $\frac{H9}{e9}$

(B) $\frac{H7}{h6}$

(C) $\frac{H7}{k6}$

(D) $\frac{H7}{p6}$

29. Which of the following mechanisms is used on a typical drill press machine to transmit power from the electric motor to the spindle?

(A) Pulley belt drive system
(B) Chain drive system
(C) Lever system
(D) Gear system

Item **30** refers to the following diagram of a plastic chair.

30. Which of the following is the BEST manufacturing process for mass producing the chair?

(A) Welding
(B) Fabrication
(C) Sand casting
(D) Injection moulding

31. Which type of gear is BEST suited for transmitting motion between intersecting shafts at right angles?

(A) Helical gear
(B) Worm gear
(C) Bevel gear
(D) Spur gear

32. In the design process, recognition of need means

(A) having persons in need of help
(B) refining a selected design solution
(C) realizing that a design is complete
(D) establishing that a component is to be designed

33. In the design process, optimization is the process of

(A) ensuring all the design parts fit
(B) testing a design for best results
(C) revealing all the features of the design
(D) creating all the ideas needed to complete the design

34. Which type of gear is BEST suited for transmitting motion between non-parallel and non-intersecting shafts?

(A) Spur gear
(B) Bevel gear
(C) Worm gear
(D) Rack and Pinion

35. A continuous, flexible device that transmits motion from one wheel or pulley to another is a

(A) gear
(B) belt drive
(C) chain drive
(D) rack and pinion

36. In utilizing the design concept, what term is used to describe the functional aspect of the design?

(A) Cost
(B) Aesthetics
(C) Ergonomics
(D) Anthropometrics

37. In using the design concept, what term is used to describe the appearance/ beautification of the design?

(A) Cost
(B) Aesthetics
(C) Ergonomics
(D) Anthropometrics

38. In the design concept, prototyping is used by the designer to

I. see the product in three dimensions
II. sell the product to clients
III. check the engineering concept

(A) I and II only
(B) I and III only
(C) II and III only
(D) I, II and III

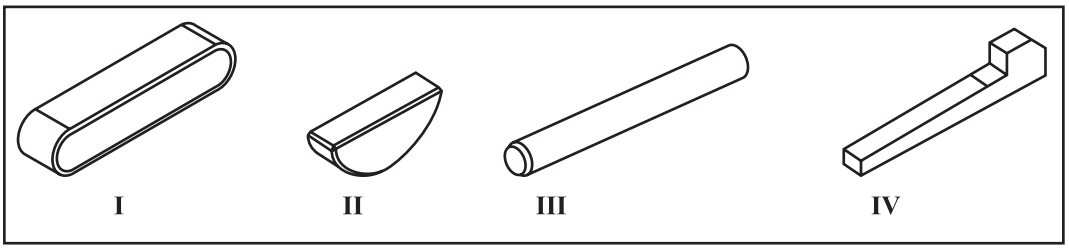
39. Which of the following couplings provide(s) an angular misalignment of up to 45°?

(A) Split
(B) Flange
(C) Friction
(D) Universal joints

40. What is the FIRST stage in the design process?

(A) Seeking the design
(B) Recognizing the need
(C) Defining the problem
(D) Specifying the parameters

Item **41** refers to the following diagram which shows a set of keys.



41. Which of the keys is a feather key?

(A) I
(B) II
(C) III
(D) IV

---

42. Which of the following clutches engages automatically as the rotational speed increases?

(A) Single-plate clutch
(B) Multi-plate clutch
(C) Centrifugal clutch
(D) Cone clutch

43. Which of the following is used in a front-wheel-drive motor vehicle to transmit power from the transmission to the wheels, allowing angular misalignment between the driving shaft and the wheel?

(A) Universal joint
(B) Flanged coupling
(C) Friction coupling
(D) Constant velocity joint

44. Shoes/pads, callipers, pistons and pins are all parts of a

(A) clutch plate assembly
(B) power steering assembly
(C) braking system assembly
(D) two-stroke engine assembly

45. Which of the following is NOT a sustainable energy source?

(A) Magnetic power
(B) Biomass power
(C) Hydropower
(D) Solar power

END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.

C A R I B B E A N E X A M I N A T I O N S C O U N C I L

CARIBBEAN ADVANCED PROFICIENCY EXAMINATION

BUILDING AND MECHANICAL ENGINEERING DRAWING

OPTION A — MECHANICAL ENGINEERING DRAWING

UNIT 2

SPECIMEN PAPER 2026

Item No.	Key	Specific Objective
1	A	2A:1:3
2	C	2A:1:3
3	A	2A:1:4
4	C	2A:1:4
5	A	2A:1:4
6	A	2A:1:1
7	D	2A:1:1
8	B	2A:1:1
9	A	2A:1:1
10	D	2A:1:3
11	C	2A:1:3
12	B	2A:1:3
13	D	2A:1:1
14	D	2A:1:1
15	A	2A:1:2
16	C	2A:2:2
17	B	2A:2:2
18	B	2A:2:2
19	D	2A:2:2
20	B	2A:2:2:
21	C	2A:2:2:
22	B	2A:2:1:
23	B	2A:2:1

Item No.	Key	Specific Objective
24	D	2A:2:1
25	B	2A:2:2
26	A	2A:2:2
27	D	2A:2:4
28	B	2A:2:4
29	A	2A:2:2
30	D	2A:2:2
31	C	2A:3:3
32	D	2A:3:3
33	B	2A:3:3
34	C	2A:3:4
35	B	2A:3:1
36	C	2A:3:3
37	B	2A:3:
38	B	2A:3:3
39	D	2A:3:1
40	B	2A:3:3
41	A	2A:3:2
42	C	2A:3:2
43	D	2A:3:1
44	C	2A:3:1
45	A	2A:3:6

CARIBBEAN EXAMINATIONS COUNCIL
BUILDING AND MECHANICAL ENGINEERING DRAWING
OPTION A – MECHANICAL DRAWING
UNIT 01– PAPER 02
TABLE OF SPECIFICATIONS
SPECIMEN UNIT 2

Module	Content	Item No.	Objectives	Profiles and Marks			Total
				Knowledge	Application	Drawing Skills	
1	Lines and planes in Space	**1(a)** (i) – (iii)	**2A:1:4(a)(c)(d),**	3	3	4	10
	Determination of Forces – Analytical method Beams	**1(b)** (i) – (iv)	**2A:1:1(a)(c)(d)**	5	7	8	20
Subtotal				**8**	**10**	**12**	**30**
2	Sustainable energy sources in the manufacturing process	**2(a)** (i) – (iii)	**2A:2:3(a),** **2A:2:4(a)(c)**	5	3	2	10
	Bearings and Bushings	**2(b)**	**2A:2:4(a)(c)**	4	6	10	20
Subtotal				**9**	**9**	**12**	**30**

Module	Content	Item No.	Objectives	Profiles and Marks			Total
				Knowledge	Application	Drawing Skills	
3	Elements of Power Transmission	**3 (a) (i)-(iii)**	**2A:3:1(a)**	2	2		4
	Chain Drive	**3 (b)**	**2A:3:1(d)**	1	2	4	7
	Brakes	**3 (c)**	**2A:3:1(e)**	5	5	8	18
Subtotal				**8**	**9**	**13**	**30**
Total				**25**	**28**	**37**	**90**

TEST CODE **02268020**

SPECIMEN 2026

CARIBBEAN EXAMINATIONS COUNCIL

CARIBBEAN ADVANCED PROFICIENCY EXAMINATION®

BUILDING AND MECHANICAL ENGINEERING DRAWING

OPTION A — MECHANICAL ENGINEERING DRAWING AND DESIGN

UNIT 2 — Paper 02

2 hours 30 minutes

GENERAL INFORMATION

1. This paper consists of THREE questions in THREE sections. Answer ALL questions.
2. Silent, non-programmable calculators may be used for this examination.
3. For this examination, each candidate should have the following.

   A minimum of six sheets of 11″ × 17″ paper
   Personal computer with monitor, keyboard, mouse and printer
   Computer-aided drafting software

   NOTE: After completing EACH question, save your work electronically as a pdf file on the available storage device. At the conclusion of the examination, the invigilator will give you instructions for submitting the saved files for printing. All work MUST be printed for submission.

INSTRUCTIONS TO CANDIDATES

1. All dimensions given are in millimetres unless otherwise stated.
2. Where scales are not stated, the full size should be applied.
3. All geometrical construction lines MUST be visible on all drawings.
4. When first-angle or third-angle is not specified, the choice of projection is left to the candidate's discretion, in which case the type of projection used MUST be clearly stated.
5. The candidate should use his/her own judgement to supply any dimensions or other details not directly shown on the drawings.
6. The number of each question MUST be written next to the solution.
7. Each candidate MUST enter his/her school code and registration number in the appropriate space at the bottom of the drawing paper.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

SECTION A

MODULE 1 — MECHANICS OF MACHINES

Answer the question in this section.

1. (a) A plan of a 75 mm line AB is 50 mm. Point A is 15 mm above the horizontal plane and 20 mm in front of the vertical plane. Point B is 75 mm in front of the vertical plane.

(i) Draw the front view and plan view of AB. **[3 marks]**

(ii) Find the inclination of AB with the horizontal plane and the vertical plane. **[3 marks]**

(iii) Show the traces. **[4 marks]**

(b) Figure 1 shows a beam that is overhanging the right-hand support, D. There are three concentrated loads acting at B, C, and E.

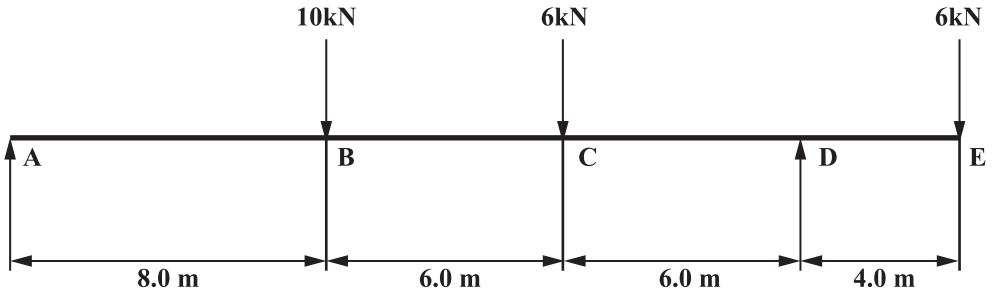


Figure 1. Beam

(i) Determine, analytically, the reactions at Supports A and D. **[5 marks]**

(ii) Draw, to a suitable scale, the shear force diagram. **[7 marks]**

(iii) Produce the bending moment diagram. **[7 marks]**

(iv) State the value of the maximum bending moment. **[1 mark]**

Total 30 marks

SECTION B

MODULE 2 — ENGINEERING MATERIALS AND PROCESSES

Answer the question in this section.

2. (a) (i) With the aid of a neat labelled sketch, illustrate how wind power is used to generate electricity. **[5 marks]**

(ii) Explain the energy conversion process illustrated in the sketch in (a) (i). **[3 marks]**

(iii) State TWO advantages of using wind power as a sustainable energy source. **[2 marks]**

(b) Figure 2 shows the parts of a bush bearing in first-angle orthographic projection.

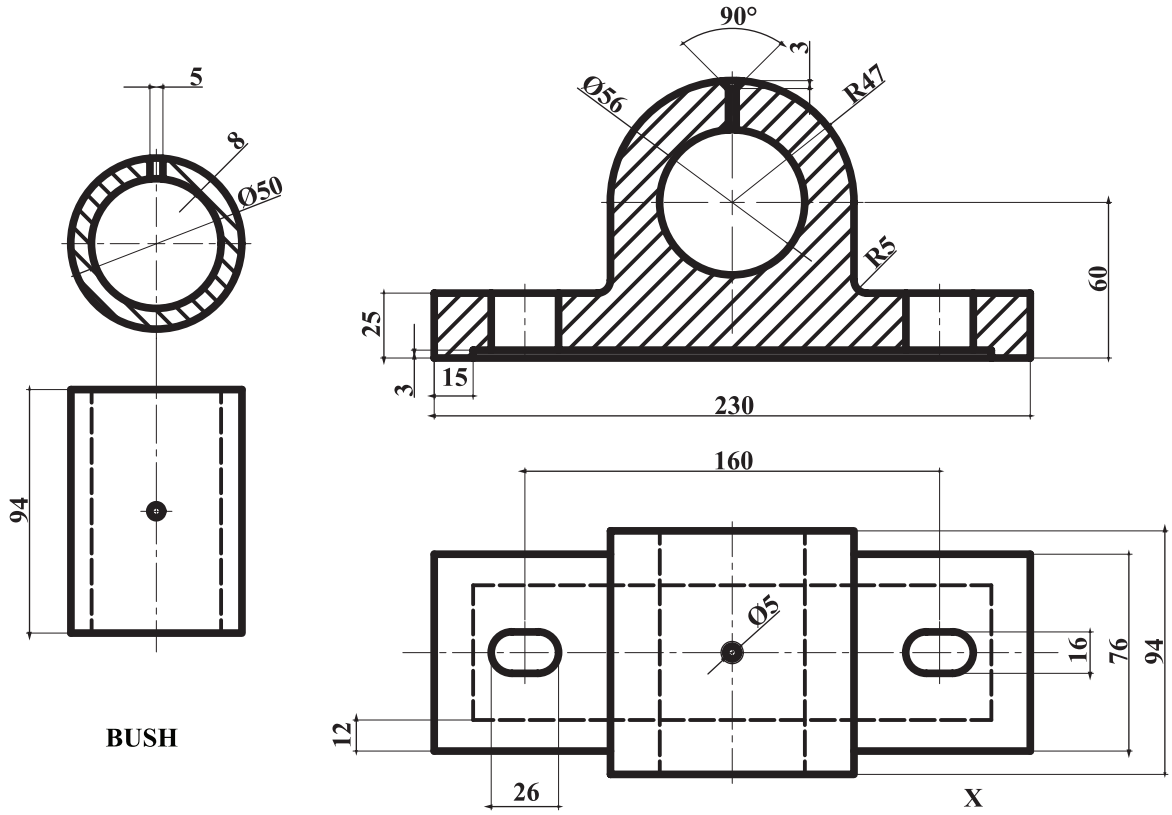


Figure 2. Bush bearing

Using the given dimensions, draw a half-sectional view in isometric projection, making X the lowest point. **[20 marks]**

Total 30 marks

SECTION C

MODULE 3 — ENGINEERING DESIGN ELEMENTS

Answer the question in this section.

3. (a) An electric motor drives a centrifugal pump that is located 2.4 m away. Their shafts cannot be perfectly aligned due to the installation process. The motor and the pump run for long periods at a time and experience slight vibration.

(i) Define the word 'coupling'. **[2 marks]**

(ii) Identify ONE type of coupling suitable for solving the problem in the scenario given. **[1 mark]**

(iii) Give TWO reasons to justify your choice of coupling in (a) (ii). **[2 marks]**

(b) Produce a labelled pictorial sketch of a good proportion of a universal coupling connecting two shafts of unequal diameters. **[7 marks]**

(c) A workshop requires a manually operated lifting system to raise a load vertically through a height of 4.0 m. The system must lift the load safely, prevent reverse motion when lifting stops and be easy to operate.

(i) Outline the steps that should be taken to design a suitable pulley system. Justify your choice. **[4 marks]**

(ii) Sketch and label the pulley arrangement. **[7 marks]**

(iii) Sketch and label a suitable braking system for preventing the load from falling. **[7 marks]**

Total 30 marks

END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.

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BUILDING AND MECHANICAL ENGINEERING DRAWING

OPTION A – MECHANICAL ENGINEERING DRAWING AND DESIGN

UNIT 2 — Paper 02

KEY AND MARK SCHEME

SPECIMEN 2026

BUILDING AND MECHANICAL ENGINEERING DRAWING

UNIT 2 — Paper 02

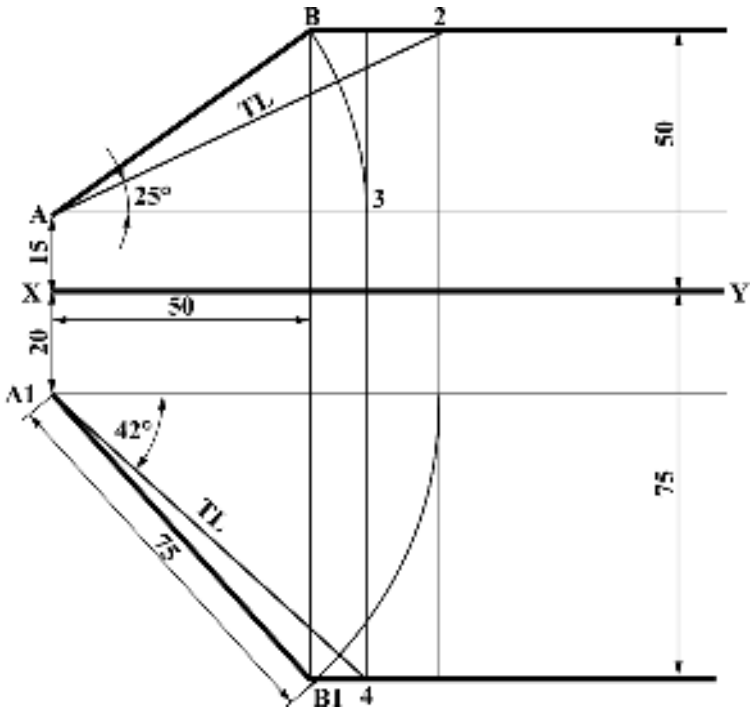
KEY AND MARK SCHEME

MODULE 1

Question 1.

Syllabus ref: 2A:1:4(a)(c)(d), 2A:1:1(a)(c)(d)

(a)(i)-(iii)



3 marks for accurately drawing the views
3 marks for finding the inclination
4 marks for showing the traces

[10 marks]

BUILDING AND MECHANICAL ENGINEERING DRAWING

UNIT 2 — Paper 02

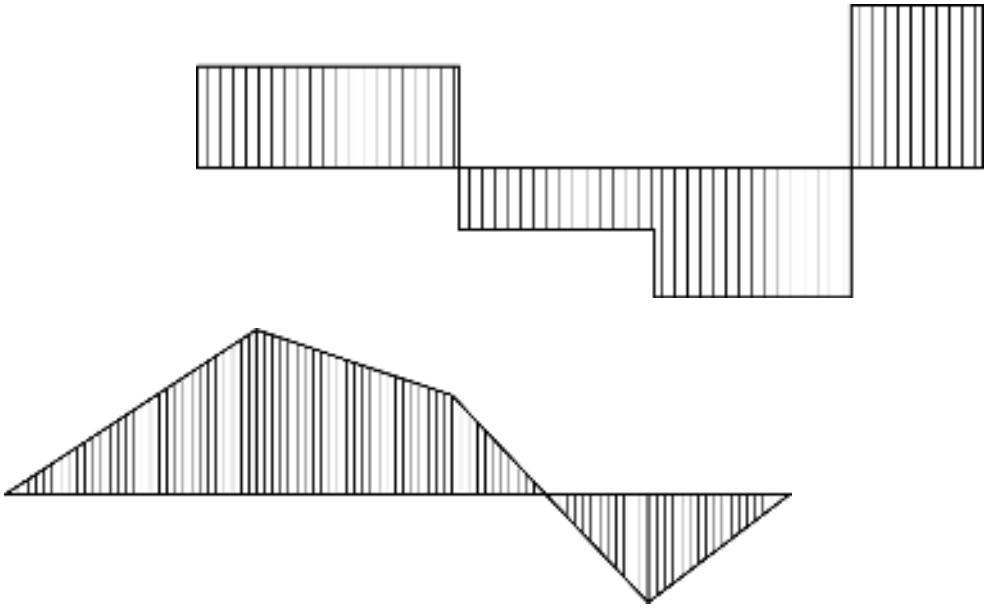
KEY AND MARK SCHEME

Question 1. (continued)

(b) (i) RA + RD =10+6+8 = 24
Taking clockwise moments @ A = 0
(10x8) +(6x14) +(-RDx20) +(8x24) = 0
80 +84 – 20RD +192 = 0
356 = 20RD
RD = 356/20 =**17.8**
RA = 24 – 17.8 = **6.2**

[5 marks]

(ii) and (iii)



14 marks for completed shear force and bending moment diagrams

(iv) **1 mark for maximum bending moment: Mmax = 49.6 kN\at Point B**

Total 30 marks

		Criteria	**K**	**A**	**DS**
(a)	(i)	Drawing the front and plan views	**1**	**1**	**1**
	(ii)	Finding the inclination	**1**	**1**	**1**
	(iii)	Showing the traces	**1**	**1**	**2**
(b)	(i)	Performing the analytical calculation	**2**	**3**	
	(ii)	Drawing the shear force diagram	**1**	**2**	**4**
	(iii)	Producing the bending moment diagram	**1**	**2**	**4**
	(iv)	Stating the maximum bending moment	**1**		
			8	**10**	**12**

BUILDING AND MECHANICAL ENGINEERING DRAWING

UNIT 2 — Paper 02

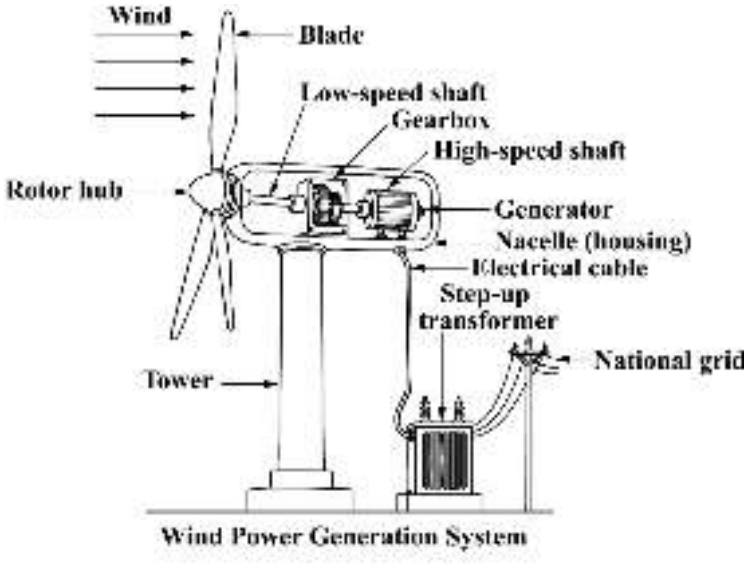
KEY AND MARK SCHEME

MODULE 2

Question 2.

Syllabus ref: 2A:2:3(a), 2A:2:4(a)&(c)

(a) (i)



2 marks for an accurate sketch

3 marks for at least three labels correctly placed

(ii) Energy conversion process

Wind causes the turbine blades to rotate, converting the wind's kinetic energy into mechanical energy **(1).** The rotating shaft drives the gearbox, which increases the rotational speed before transmitting the motion to the generator **(1).** The generator converts the mechanical energy into electrical energy, which is then stepped up by a transformer before being supplied to the national grid or consumers **(1).**

(3 marks)

Question 2. (continued)

(iii) Two Advantages of Using Wind Power

- Wind is a renewable energy source.
- Wind power produces little or no greenhouse gas emissions during operation.
- Wind does not require fuel for electricity generation.
- Operating costs are relatively low after installation.
- Wind reduces dependence on fossil fuels.

1 mark each for any two correct advantages given

(2 marks)

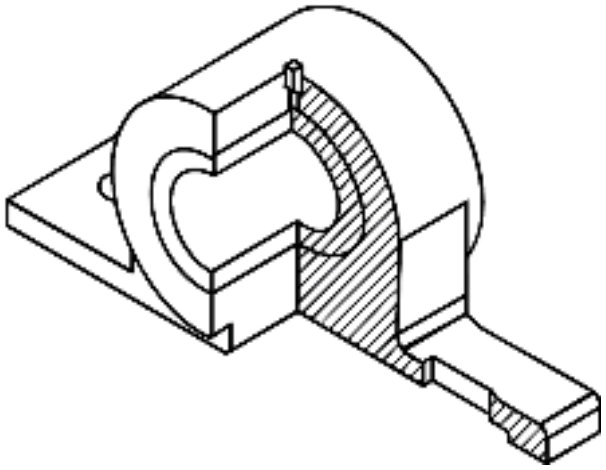
BUILDING AND MECHANICAL ENGINEERING DRAWING

UNIT 2 — Paper 02

KEY AND MARK SCHEME

Question 2. (continued)

(b)



20 marks for accurately drawing a half-sectional view in isometric projection

Total 30 marks

		Criteria	**K**	**A**	**DS**
(a)	(i)	Illustrating wind-powered electricity generation by a labelled sketch	2	1	2
	(ii)	Explaining the energy conversion process	1	2	
	(iii)	Stating two advantages of using wind power	2		
(b)		Converting from orthographic to isometric	1	1	1
		Assembling parts in isometric	1	2	3
		Half-sectioning in isometric with X being the lowest point	1	2	5
		Hatching	1	1	1
			8	**8**	**14**

BUILDING AND MECHANICAL ENGINEERING DRAWING

UNIT 2 — Paper 02

KEY AND MARK SCHEME

MODULE 3

Question 3.

Syllabus ref: 2A:3:1(a), 2A:3:1(d)&(e)

(a) (i) Definition of coupling: A coupling is a mechanical device used to connect two shafts together **(1)** so that power and motion can be transmitted from one shaft to another **(1).**

OR

A coupling joins two rotating shafts to transmit torque **(1)** while allowing for alignment or slight movement **(1).**

2 marks for giving a correct definition

(ii) One type of coupling suitable for the scenario given is a flexible coupling (Pin and Bush type)

1 mark for an accurate response

(iii) It is most suitable because it

- accommodates shaft misalignment
- absorbs vibration
- reduces shock transmission
- improves service life during continuous operation

1 mark each for any two justifications given

[2 marks]

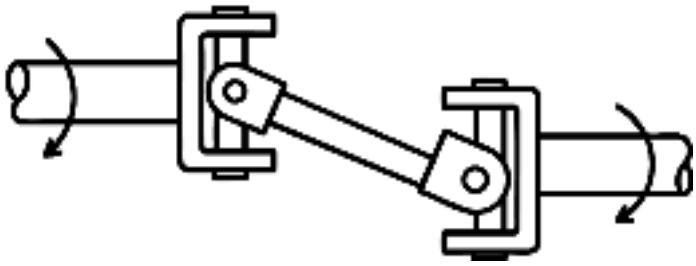
BUILDING AND MECHANICAL ENGINEERING DRAWING

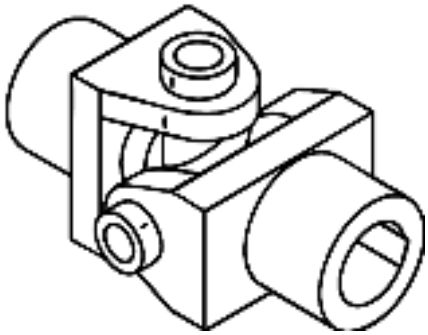
UNIT 2 — Paper 02

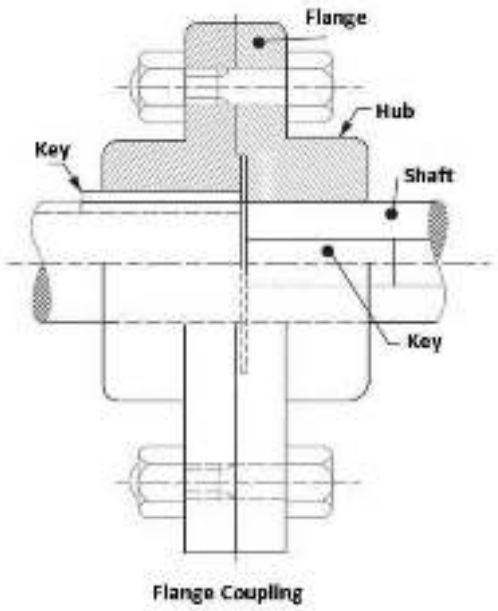
KEY AND MARK SCHEME

Question 3. (continued)

(b) Examples of universal coupling sketches







3 marks for at least three labels correctly placed
4 marks for the pictorial sketch of a universal coupling

Question 3. (continued)

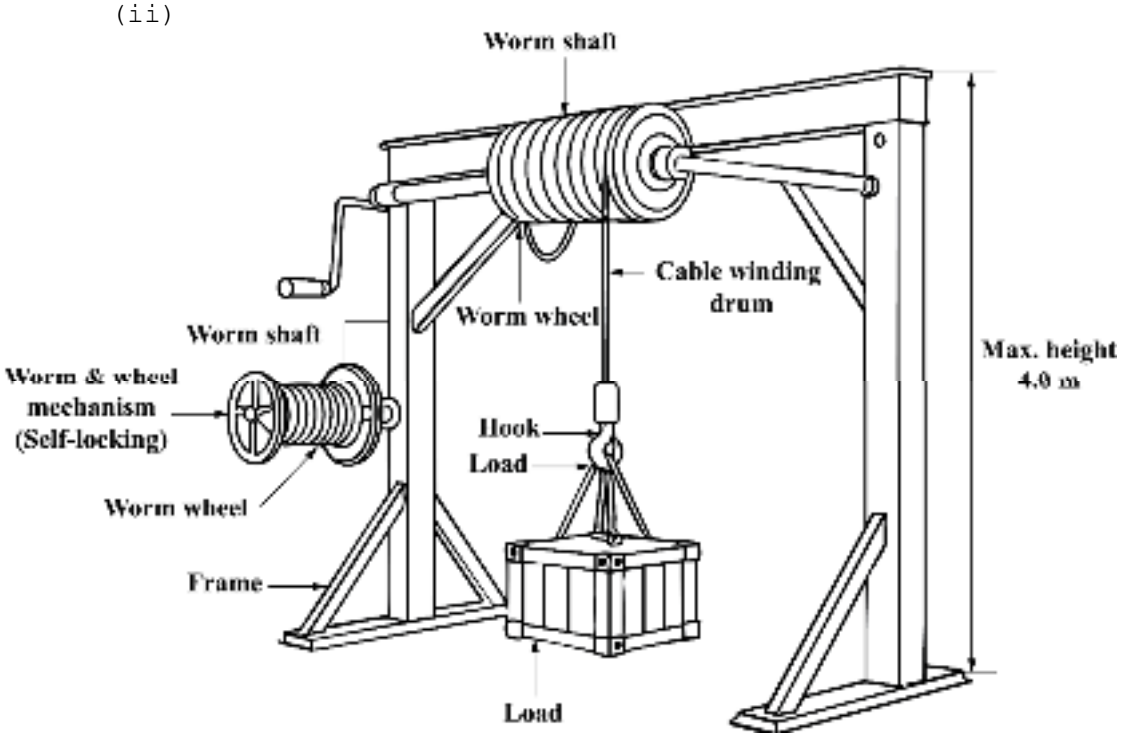
(c) (i) Steps Used to Design a Suitable Pulley System

- Determine purpose
- Determine load
- Select pulley diameter based on load
- Select belt or rope material based on strength and flexibility
- Prepare technical drawings
- Create prototype and test
- Make the necessary adjustments

3 marks for any three steps outlined

1 mark for relevant justification given

(ii)



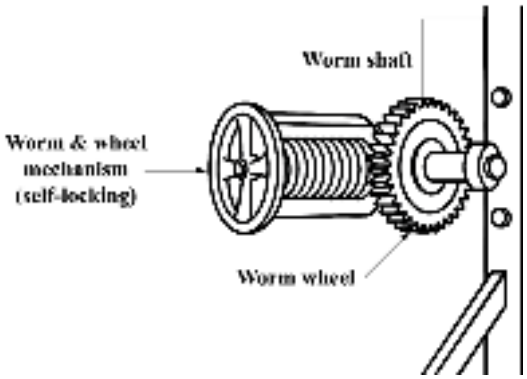
4 marks for sketching the pulley arrangement
3 marks for at least 3 labels correctly placed

BUILDING AND MECHANICAL ENGINEERING DRAWING

UNIT 2 — Paper 02

KEY AND MARK SCHEME

(ii)



4 marks for sketching the braking system

3 marks for at least 3 labels correctly placed

Total 30 marks

Criteria			**K**	**A**	**DS**
(a)	(i)	Defining 'coupling'	1		
	(ii)	Identifying a coupling that could solve the problem	1		
	(iii)	Giving two justifications		2	
(b)		Producing a labelled pictorial sketch	1	2	4
(c)	(i)	Outlining and justifying the steps	3	1	
	(ii)	Sketching and labelling the pulley arrangement	1	2	4
	(ii)	Sketching and labelling the braking system	1	2	4
			8	**9**	**13**

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