

REPUBLIC OF SOUTH AFRICA

SYLLABUS

ENGINEERING DRAWING

N1

CODE NUMBER: 08090261

DATE OF IMPLEMENTATION
JANUARY 1996

DATE OF FIRST EXAMINATION
APRIL 1996

ENGINEERING DRAWING N1

1. SUBJECT AIMS

1.1 GENERAL AIMS

1.1.1 The student must be able to

- * identify the function of engineering drawing in the engineering industry; and
- * interpret engineering drawing as an accurate and meaningful manner of communication, since drawing is the language used in the engineering industry.

1.1.2 The student must develop insight and spatial perception to perceive three-dimensional objects from two-dimensional representations.

1.1.3 The lecturer must convey the subject content in such a manner that it will awaken appreciation in the student for the subject.

1.1.4 The lecturer must integrate with the students' overall training and support the teaching and learning of the other instructional offerings.

1.2 SPECIFIC AIMS

1.2.1 The student must

- * be able to read and interpret elementary engineering drawings
- * be equipped with knowledge and skill in engineering drawing so that he/she will be able to produce drawings with emphasis on the following:
 - Correctness
 - Linework
 - Speed
 - Accuracy
 - Balanced layout and neatness
- * be aware of developments in engineering drawing technology
- * be equipped with knowledge and skill concerning the following content: general engineering drawing terms; drawing

equipment and drawing technique; free-hand drawing; geometrical construction; reproduction drawing; first angle orthographic projection; axonometrical drawing; orthographic projection of prisms and pyramids; and sectional drawing of single items.

2. DURATION OF INSTRUCTIONAL OFFERING

Full-time: One Trimester
Part-time: One Trimester

3. EVALUATION

3.1 Continuous evaluation

Class tests must be conducted continuously.

3.2 Pass requirements

The candidate must obtain at least 40% in the examination to pass the instructional offering.

3.3 Examination paper

One four hour closed-book examination paper will be set.

4. EXAMINING

The level of difficulty related to knowledge, skill, comprehension and application are important and should be as follows:

KNOWLEDGE AND SKILL	COMPREHENSION AND APPLICATION
± 60%	± 40%

5. GENERAL INFORMATION

5.1 All drawing work must to be done in accordance with the latest issue of the SABS 0111, Code of Practice for Engineering Drawing.

5.2 Drawings must be evaluated with emphasis on the following:

- * Correctness
- * Linework

- * Speed
- * Accuracy
- * Balanced layout and neatness

- 5.3 All drawings must be done with drawing instruments. The only exceptions being printing, free-hand drawing and the C-type line/break line.
- 5.4 All printing must be done free-hand in pencil according to the SABS 0111 Code of Practice. Printing must be neatly executed in order to improve the quality of the drawing.
- 5.5 When drawings are required to be made according to first angle orthographic projection, only the primary views will be given or asked.
- 5.6 The correct subject terminology must be used throughout.

6. LEARNING CONTENT

6.1 The modules for ENGINEERING DRAWING N1 consist of the following:

MODULE	DESCRIPTION	WEIGHT VALUE(±)
1	General engineering drawing terms	(5)
2	Drawing equipment and drawing technique	(5)
3	Free-hand drawing	(10)
4	Geometrical construction	(10)
5	Reproduction drawing	(10)
6	First angle orthographic projection	(15)
7	Axonometrical drawing	(20)
8	Orthographic projection of prisms and pyramids	(10)
9	Sectional drawing of single items	(15)
	TOTAL	(100)

6.2 The weight value (WV) of a module

- * gives an indication of the percentage of the total content of the work which is occupied by the module;
- * gives an indication of the percentage of the time available for the instruction offering, which is to be spent on the module; and
- * gives an indication of the percentage of the total of marks of the examination paper, which is to be allocated to the module.

7. DETAILED SYLLABUS

MODULE 1: DRAWING TERMINOLOGY, ABBREVIATIONS AND COMPUTER AIDED
DRAUGHTING (CAD) (WV 5)

On completion of this module the student must be able to

1.1 identify and apply the abbreviation for the following terms used in Engineering Drawing:

- | | |
|------------------|-------------------------|
| * Across flats | * Countersunk head |
| * Across corners | * Counterbore |
| * Assembly | * Hexagon head |
| * Chamfered | * Pitch circle diameter |
| * Countersunk. | |

1.2 name the following types of plotters and printers used in industry and give one advantage and one disadvantage of each type:

- * Pen plotters
- * Ink jet plotters
- * Thermal printers
- * Laser printers.

1.3 list and describe the following types of storing devices:

- * Floppy and stiffy disks
- * Hard drive/fixed disk
- * Tape streamer
- * Data disk.

1.4 explain why back-up systems are necessary.

DIDACTICAL GUIDELINES

- * Effective use can be made of multi-choice type of questions for testing and evaluation.
- * Develop the students' understanding of computers and CAD by demonstrating the actual hardware and software wherever possible.
- * Effective use can be made of available wall charts.

MODULE 2: DRAWING INSTRUMENTS AND DRAWING TECHNIQUE**(WV 5)**

On completion of this module the student must be able to

- 2.1 identify, use and take care of the following drawing instruments:

Drawing paper, 0,3mm and 0,5mm pencils, leads, plastic-type eraser, duster, drawing board, T-square, bow-compass, scale-rule with at least the following scales: 1:1, 1:2, 1:5, 1:10 and 2:1, set-squares (30, 60 and 45 degrees with scribed space lines for sectioning), drawing clamps or masking tape.

- 2.2 identify and correctly use the following line types:

A, B, C, F, G, H and construction line.

- 2.3 print alpha-numerically in free-hand.

DIDACTICAL GUIDELINES

- * Refer to SABS 0111 and the additional Code of Practice for Engineering Drawing as used by technical colleges for line, letter and figurework.
- * Attention must be continuously given to the correctness and quality of line, letter and figurework in all modules.
- * Printing must be done between construction lines.
- * Two clutch pencils of the following line thicknesses must be used for linework: 0,3 or 0,5 or 0,7.

MODULE 3: FREE-HAND DRAWING

(WV 10)

On completion of this module the student must be able to

3.1 draw free-hand, from given drawings the following hand tools:

- * Hammers
- * Pliers
- * Chisels
- * Hack-saw
- * Spanners
- * Screwdrivers.

3.2 draw free-hand, from given drawings the following wire and cable terminations:

- * Crimping lug
- * Cable gland for SWA cable
- * Compression cable glands.

3.3 draw free-hand, from given drawings the following PVC conduit fittings and fasteners:

- * Male adapter
- * Female adapter
- * 20 mm PVC connection box
- * 20 mm PVC inspection coupling.

DIDACTICAL GUIDELINES

- * All linework in freehand drawing must be done with a 0,5 mm or 0,7 mm pencil.
- * Attention should continuously be given to freehand drawing in all the modules.
- * Square-grid paper could be used to develop skill and proportion in freehand drawing.

MODULE 4: GEOMETRICAL CONSTRUCTION

(WV 10)

On completion of this module the student must be able to

4.1 complete the following geometrical constructions with the aid of drawing instruments:

- * Bisect a line segment
- * Bisect an angle
- * Construct a perpendicular line from a given point on a line
- * Construct a perpendicular line from a given point outside a given line
- * Construct a perpendicular line at the end of a given line segment
- * Construct a line parallel to another line at a given distance
- * Construct a circle through three given points
- * Draw parallel lines using set squares
- * Construct an arc to lines that form a right angle, an obtuse angle and an acute angle
- * Construct an arc to a line and an arc
- * Construct an arc to two other arcs
- * Construct an ellipse by means of the four centre method
- * Transfer a given angle
- * Divide a given line segment into an amount of equal segments
- * Construction of a hexagon
- * Construction of an octagon
- * Construction of an equilateral triangle
- * Construction of a square.

MODULE 5: REPRODUCTION DRAWING

(WV 10)

On completion of this module the student must be able to

5.1 draw, with the aid of drawing instruments, the following geometrical plane figures:

- * Triangles
- * Squares
- * Rectangles
- * Rhombus
- * Parallelograms
- * Trapeziums
- * Regular hexagons
- * Regular octagons.

5.2 draw a view of a single object or casting to one of the following scales, using a scale rule:

- * 1:1
- * 1:2
- * 1:5
- * 1:10
- * 2:1.

NOTE

The construction of the scales is not part of the syllabus.

An ellipse and other geometrical constructions may be incorporated in these reproduction drawings.

Drawings to be complete with dimensions, titles and scales.

DIDACTICAL GUIDELINES

- * Practice in this module will develop good linework and drawing technique.
- * Square grid paper could be used for additional exercise in this module.

MODULE 6: FIRST ANGLE ORTHOGRAPHIC PROJECTION

(WV 15)

On completion of this module the student must be able to

6.1 draw, from the following initial situations, the primary views of elementary single objects, according to scale and in first angle orthographic projection:

- * An isometric drawing is given from which two or three primary views must be drawn
- * Two views are given from which a third view is drawn by means of projection.

The following scales can be used to draw the various views: 1:1 or 1:2 or 1:5 or 1:10 or 2:1

Hidden detail may be required.

Centre lines should be inserted.

Dimensions may be required.

Title and scale may be required.

6.2 draw the symbol for first angle orthographic projection.

DIDACTICAL GUIDELINES

- * The principle of first angle orthographic projection should be explained and demonstrated with the aid of a model which illustrates the principal reference planes ie horizontal and vertical.
- * Special reference should be made to the viewing position, placing of objects, rabatting (opening out) of reference planes and the placement of the orthographic representations.
- * A model, drawn isometrically as well as in first angle orthographic projection on a large wall chart, can be successfully applied.
- * Drawing to scales other than 1:1 should only be attempted once the student is competent in the use of first angle orthographic projection.
- * Models, clay or modelling wax can be used to assist the student in visualizing and developing the necessary perception.
- * Refer to SABS 0111 for the designation of the primary views.

MODULE 7: AXONOMETRICAL DRAWING

(WV 20)

On completion of this module the student must be able to

7.1 draw an oblique view of a single object of which at least two views are given in first angle orthographic projection. The following must be considered:

- * The cabinet method is to be used where all oblique lines are halved to compensate for the lack of perspective.
- * The object is to be given in such a manner that the view containing circles or arcs is to be in the front view.
- * Students are not required to draw an oblique circle or an oblique arc.
- * Interpenetrations and fillet radii are not to be included in oblique drawing.
- * No dimensions are required.
- * Hidden detail may be required.

7.2 make an isometric drawing of a single object of which at least two views are given in first angle orthographic projection. The following must be considered:

- * Isometric circles and arcs are not required.
- * Non-isometric lines may be drawn at any angle.
- * Interpenetrations and fillet radii are not to be included in isometric drawing.
- * No dimensions are required.
- * Centre lines may be required.
- * Hidden detail may be required.
- * The isometric scale is not required.

DIDACTICAL GUIDELINES

- * Models , wall charts as well as clay or modelling wax can be beneficially used to assist the student to visualize three dimensional objects and to develop the necessary insight

- * Freehand isometric drawing, using isometric grids should be used to further develop insight and spatial perception skills in this module.

- * Hidden detail in isometric drawing is generally reserved for holes or channels, to indicate whether the detail has a 'dead-end ' or passes right through the object. The more complex the drawing the more confusion is created with the insertion of all the hidden detail.

MODULE 8: ORTHOGRAPHIC PROJECTION OF PRISMS AND PYRAMIDS (WV 10)

On completion of this module the student must be able to draw from a given front view of a prism or pyramid that is placed at an incline and then project the left view and/or top view in first angle orthographic projection. The following must be considered:

- * Regular, right prisms and pyramids with triangular, square, hexagonal, octagonal and circular bases may be required.
- * The given prism or pyramid must be placed in the first quadrant with its axis at an angle of 30 degrees, 45 degrees, 60 degrees or 90 degrees with the horizontal plane and parallel to the vertical plane.
- * Where necessary an auxiliary view must be used with the front view.
- * Only views of single prisms or pyramids may be asked.
- * The symbol for first angle orthographic projection may be required.
- * Hidden detail may be required.
- * No dimensioning is required.

DIDACTICAL GUIDELINES

- * It is necessary to have available, in the classroom, models of the prisms and pyramids concerned.
- * The student should firstly be taught to project the primary views of the prisms or pyramids with their axes perpendicular to the horizontal plane and parallel to the vertical plane before the prisms or pyramids are drawn in inclined positions.
- * Auxiliary views should be drawn with normal outlines ie type A-lines.

MODULE 9: SECTIONAL DRAWING OF SINGLE ITEMS

(WV 15)

On completion of this module the student must be able to draw the primary views of elementary, single machine parts according to a scale in first angle orthographic projection. The following must be considered:

- * Sectional views are limited to full sections and half sections.
- * Elementary machine parts used should not have interpenetration curves or fillet radii (only sharp corners).
- * Machine parts with webs or ribs are not required.
- * Outside views with or without hidden detail may be required.
- * Hidden detail is not required to be drawn on the portion in section.
- * Dimensioning may be required.

DIDACTICAL GUIDELINES

- * Sectional models and plasticine could be used to assist the students to develop the necessary insight and spatial perception.
- * Cutting planes lines are short chain lines suitably thickened at the ends (refer to Code of Practice for Engineering Drawing, SABS 0111).
- * Section lines must be evenly spaced, drawn with the Type B-line and drawn at 45 degrees as the norm.
- * Scribed set squares should be used to ensure equal spacing of section lines. The scribed side must be placed flush to the drawing sheet to avoid the error of parallax.

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REPUBLIC OF SOUTH AFRICA

SYLLABUS

ENGINEERING DRAWING

N2

CODE NUMBER: 08090272

DATE OF IMPLEMENTATION
APRIL 1996

DATE OF FIRST EXAMINATION
AUGUST 1996

ENGINEERING DRAWING N2

1. SUBJECT AIMS

1.1 GENERAL AIMS

1.1.1 The student must be able to

- * identify the function of engineering drawing in the engineering industry; and
- * interpret engineering drawing as an accurate and meaningful manner of communication, since drawing is the language used in the engineering industry.

1.1.2 The student must develop insight and spatial perception to perceive three-dimensional objects from two-dimensional representations.

1.1.3 The lecturer must convey the subject content in such a manner that it will awaken appreciation in the student for the subject.

1.1.4 The lecturer must integrate with the students' overall training and support the teaching and learning of the other instructional offerings.

1.2 SPECIFIC AIMS

1.2.1 The student must

- * develop the ability to read and interpret engineering drawings
- * develop his/her ability to produce engineering drawings
- * be aware of developments in engineering drawing technology
- * be equipped with knowledge and skill concerning the following content: drawing terminology, abbreviations and computer-aided draughting (CAD); fastening devices and welding; screw threads; machining symbols; first angle orthographic projection; isometric drawing; third angle orthographic projection; and interpenetrations.

2. DURATION OF INSTRUCTIONAL OFFERING

Full-time: One Trimester
 Part-time: One Trimester

3. EVALUATION

3.1 Continuous evaluation

Class tests must be conducted continuously.

3.2 Pass requirements

The candidate must obtain at least 40% in the examination to pass the instructional offering.

3.3 Examination paper

One four hour closed-book examination paper will be set.

4. EXAMINING

The level of difficulty related to knowledge, skill, comprehension, application, analysis and synthesis is important and should be as follows:

KNOWLEDGE AND SKILL	COMPREHENSION AND APPLICATION	ANALYSIS AND SYNTHESIS
± 45%	± 35%	± 20%

5. GENERAL INFORMATION

5.1 All drawing work must be done in accordance with the latest issue of the SABS 0111, Code of Practice for Engineering Drawing and SABS 044 - Part 2, Code of Practice for Welding.

5.2 Drawings must be evaluated with emphasis on the following elements:

- * Correctness
- * Linework
- * Speed
- * Accuracy
- * Balanced layout and neatness

- 5.3 All drawings, including machining symbols, must be done with drawing instruments. The only exceptions being printing, free-hand drawing and the C-type line/break line.
- 5.4 All printing must be done in pencil according to the SABS 0111 Code of Practice, either free-hand or by using a stencil. Printing must be neatly executed in order to improve the quality of the drawing.
- 5.5 When drawings are required to be made according to first or third angle orthographic projection, only the primary views will be given or asked.
- 5.6 The correct subject terminology must be used throughout.

6. LEARNING CONTENT

6.1 The modules for ENGINEERING DRAWING N2 consist of the following:

MODULE	DESCRIPTION	WEIGHT VALUE(±)
1	Drawing terminology, abbreviations and computer aided draughting (CAD)	(5)
2	Fastening devices and welding	(15)
3	Screw threads	(10)
4	Machining symbols	(5)
5	First angle orthographic projection	(20)
6	Isometric drawing	(15)
7	Third angle orthographic projection	(20)
8	Interpenetrations	(10)
TOTAL		(100)

6.2 The weight value (WV) of a module

- * gives an indication of the percentage of the total content of the work which is occupied by the module;
- * gives an indication of the percentage of the time available for the instruction offering, which is to be spent on the module; and
- * gives an indication of the percentage of the total of marks of the examination paper, which is to be allocated to the module.

7. DETAILED SYLLABUS

MODULE 1: GENERAL ENGINEERING DRAWING TERMS

(WV 5)

On completion of this module the student must be able to

1.1 identify and correctly use the abbreviation for the following terms used in Engineering Drawing:

- | | |
|----------------------------|---------------------|
| * Centres | * Internal diameter |
| * Centre-line | * Outside diameter |
| * Cylinder and cylindrical | * Material |
| * Degree (of angle) | * Maximum |
| * Diameter | * Metre |
| * Drawing | * Millimetre |
| * Hexagon | * Radius. |

1.2 give the basic function of the following hardware and software as used in Computer Aided Draughting (CAD):

- | | |
|-----------------------------------|---|
| * DOS (disk operating system) | * Monitor |
| * CAD (computer aided draughting) | * Hard drive/fixed disk |
| * Keyboard | * CD ROM (compact disk, read only memory) |
| * Mouse | * Floppy disk |
| * Tablet | * Stiffy disk |
| * Scanner | * Directory |
| * CPU (central processing unit) | * Sub-directory |
| * RAM (random access memory) | * Files |
| * ROM (read only memory) | |
| * Plotter/printer. | |

DIDACTICAL GUIDELINES

- * Effective use can be made of multi-choice type of questions for testing and evaluation.
- * Develop the students' understanding of computers and CAD by demonstrating the actual hardware and software wherever possible.
- * Effective use can be made of available wall charts

MODULE 2: FASTENING DEVICES AND WELDING

(WV 15)

On completion of this module the student must be able to

2.1 draw and construct views of hexagonal head bolts, nuts, studs, drilled holes and tapped holes by using the conventional method.

2.2 draw free-hand and identify the specific application of the following:

2.2.1 Bolt heads

- * square-head bolt;
- * tee-head bolt;
- * cheese-head bolt; and
- * hook-head bolt.

2.2.2 Machine screw heads

- * round head;
- * cheese head;
- * fillister head;
- * socket head;
- * countersunk head; and
- * instrument head.

2.2.3 Locking Devices

- * spring washer;
- * simmonds nut;
- * slotted nut;
- * castle nut;
- * tab washer;
- * lock-nut; and
- * parallel, taper and gib-head keys.

2.2.4 PVC conduit fittings and fasteners

- * male and female adapter;
- * 20 mm connection box; and
- * 20 mm inspection coupling.

2.2.5 Metal conduit fittings and fasteners

- * 20 mm lock-nut;
- * 20 mm female bush/bush nut;
- * 20 mm end box; and

* distribution board entry off-set.

2.3 Draw free-hand and identify the following types of welded joints:

* butt, lap, tee and corner.

2.4 Apply welding symbols to specify the following three welds:

* square butt weld;

* single V-butt weld; and

* fillet weld.

2.5 Interpret and indicate the following supplementary symbols:

* weld all round;

* weld on site; and

* weld all round on site.

Note: All welding symbols must comply with the Code of Practice for Welding, SABS 044 - Part 2.

DIDACTICAL GUIDELINES

* The approximate proportions given below should be used for the construction of the following:

- Hexagonal bolt/nut	=	1,5 D (across flats)
- Height of bolt head	=	0,7 D
- Height of nut	=	0,8 D
- Thread	=	0,1 D
- Thread before nut	=	0,3 D
- Thread after nut	=	0,3 D.

* A nut/bolt template may be used.

* When drawing fastening devices in position, care should be taken with regard to the line types as well as the relevant angle of drilled and tapped holes and stud chamfers.

* The approximate proportions given below should be used for the construction of the following:

- Width of Key	=	0,25 D
- Length of Key	=	1,5 D

- Taper of Key = 1:100
- Thickness of Key = 0,167 D.

Where D is the nominal diameter of the shaft.

- * When inserting welding symbols on a drawing it is necessary to indicate on which side of the reference line the welding must be done.
- * Welding symbols should be approximately 5 mm to 8 mm in size and drawn with a type A-line.
- * The reference line and indicating line should be drawn with a type B-line.
- * Each lecturer presenting this module should consult the Code of Practice for Welding, SABS 044 - Part 2.

MODULE 3: SCREW THREADS

(WV 10)

On completion of this module the student must be able to

- 3.1 draw the following representations of metric screw threads:
 - 3.1.1 Detailed representation of internal/external single-start left and righthand V-screw threads.
 - 3.1.2 Detailed representation of internal/external single-start left and righthand square threads.
- 3.2 explain the relevant terminology applicable to screw threads.

DIDACTICAL GUIDELINES

- * The difference between left and righthand screw threads should be clearly demonstrated by means of models.
- * The construction of the true helical forms is not required.
- * The difference between the detailed and conventional representation of screw threads should be clearly explained.

MODULE 4: MACHINING SYMBOLS

(WV 5)

On completion of this module the student must be able to

- 4.1 draw the basic machining symbol
- 4.2 identify and use the correct machining symbol to indicate that
 - * material must be removed by machining
 - * machining is not permitted.
- 4.3 read and correctly apply surface texture symbols from a table giving roughness values and grade numbers.
- 4.4 specify surface textures by using the appropriate machining symbol with the required roughness value.
- 4.5 specify a production method, treatment, or coating for producing a surface texture including the following:
 - * specifying the sampling length
 - * indicating the direction of lay
 - * indicating machining allowance
 - * avoiding unnecessary repetition of a symbol.
- 4.6 use the correct method for indicating the symbols as well as a suitable size and proportion for the symbols.

DIDACTICAL GUIDELINES

- * Refer to the latest copy of SABF 0111, Code of Practice for Engineering Drawing and the additional Code of Practice for Engineering drawing at technical colleges.
- * Extracts from tables for machining symbols will be given in the examination paper. Students are not required to purchase their own tables.
- * Emphasize that the machining symbol must be placed so that it:
 - may be read from the bottom or
 - may be read from the righthand side of the side of the drawing sheet.
- * Use models with appropriate surface textures to demonstrate the significance of the symbols to the students.

- * Arrange a visit to a machine shop, to show the students which machines are used to obtain the various types of surface textures.

MODULE 5: FIRST ANGLE ORTHOGRAPHIC PROJECTION

(WV 20)

On completion of this module the student must be able to

5.1 draw the primary orthographic views to scale including full, half or partial sectional views of castings or multi-part objects of the following:

- | | |
|--|---------------------------|
| * Knuckle joints | * Isolating links |
| * Cottered joints | * Safety valves |
| * Flanged couplings | * Knife switches |
| * Simple bearings | * Motor foot plate |
| * Brackets | * Electric motor armature |
| * Pulleys | * Gearplate |
| * Connecting rods | |
| * Internal combustion engine pistons | |
| * Electric motor fan and housing | |
| * Distribution board and mounting chassis. | |

5.2 draw the orthographic views to scales of 1:1, 1:2, 1:5 1:10 and 2:1.

5.3 draw the recognised symbol of projection for first angle orthographic projection.

The following must be considered:

- * Assemblies of multi-part objects must have a maximum of five components excluding fasteners.
- * The fastening devices required are those listed in module 2.
- * Drilled and tapped holes, bolts, nuts and studs are to be indicated in conventional representation.
- * Items that are not sectioned in their length, i.e. fastening devices, pins, shafts, spokes, ribs and webs.
- * Dimensioning and printing of the title and scale may be required.

DIDACTICAL GUIDELINES

- * Refer to the latest copy of the SABS 0111, Code of Practice for Engineering Drawing and the additional Code of Practice for engineering drawing at technical colleges.

- * Use various models and wall charts to assist with the visualization and perception and give more meaning of the contents to the students.
- * Cutting planes lines are short chain lines suitably thickened at the ends (refer to the SABS 0111, Code of Practice for Engineering Drawing).
- * Note should be taken that the angle of sectioning is normally 45 degrees.
- * Section lines must be equally spaced, drawn with the Type B-line.
- * Scribed set squares should be used to ensure equal spacing of the section lines. The scribed side must be placed flush to the drawing sheet to avoid the error of parallax.
- * Hidden detail on views that are in section is not shown unless it is absolutely necessary.

MODULE 6: ISOMETRIC DRAWING

(WV 15)

On completion of this module the student must be able to draw an isometric drawing of a single item of which at least two views are given in first angle orthographic projection. The following must be considered:

- * The isometric four centre method should be used for the construction/drawing of isometric circles and arcs.
- * Hidden detail may be required.
- * Centre lines should be inserted where appropriate.
- * Dimensions are not required.
- * The isometric scale is not required.

DIDACTICAL GUIDELINES

- * Models, wall charts as well as clay or modelling wax can be beneficially used to assist the student to visualize three dimensional objects and to develop the necessary insight.
- * Free-hand isometric drawing, using isometric grids should be used to develop skills in this module.
- * Hidden detail in isometric drawing is generally reserved for holes or channels, to indicate whether the detail has a 'dead-end ' or passes right through the object. The more complex the drawing the more confusion is created with the insertion of all hidden detail.
- * The isometric scale is not used in isometric drawing

MODULE 7: THIRD ANGLE ORTHOGRAPHIC PROJECTION

(WV 20)

On completion of this module the student must be able to

- 7.1 draw the primary orthographic views to scale including a full, half or partial sectional views of castings or multi-part objects, from the following starting situations:
- * An isometric drawing is given of which two or three views must be drawn according to third angle orthographic projection.
 - * Two views (outside or sectional) of a single item or multi-part objects are given in third angle orthographic projection from which a third view must be drawn with the aid of projection.
- 7.2 draw the orthographic views to scales of 1:1, 1:2, 1:5, 1:10 and 2:1.
- 7.3 draw the recognised symbol of projection for third angle orthographic projection.

The following must be considered:

- * Assemblies of multi-part objects must have a maximum of five components excluding fasteners.
- * Drilled and tapped holes, bolts, nuts and studs are to be indicated in conventional representation.
- * The fastening devices required are those listed in module 2.
- * Items that are not sectioned in their length, i.e. fastening devices, pins, shafts, spokes, ribs and webs.
- * Dimensioning and printing of the title and scale may be required.

DIDACTICAL GUIDELINES

- * Refer to the latest copy of the Code of Practice for Engineering Drawing - SABS 0111 and the additional Code of Practice for Engineering drawing at technical colleges.
- * Use various models and wall charts to assist with visualization

and perception.

- * Note should be taken of the angle and the equal spacing of section lines (45 degrees is accepted as the norm).
- * Hidden detail is not shown on views that are in section unless it is absolutely necessary.
- * The principles of third angle orthographic projection should be demonstrated by means of the principal reference planes (horizontal and vertical) with special reference to the viewing position, placing of objects, rabatting (opening out) of reference planes and the placement of orthographic representations.

MODULE 8: INTERPENETRATIONS

(WV 10)

On completion of this module the student must be able to:

8.1 draw a given view and insert the curve of interpenetration of the following pipes or prisms:

* Triangular, square, rectangular, hexagonal, octagonal, circular

8.2 draw given views and insert curves of interpenetration for the following:

* T-ends, fork-ends and rod-ends

The following must be considered:

- * The axes of the pipes and prisms must intersect at right angles and both axes must be parallel to one of the principal planes.
- * The axes must lie in the same parallel plane (not offset).
- * For the construction of the curve of interpenetration in T-ends fork-ends and rod-ends a minimum of five points per symmetrical half is required, i.e a starting point, a turning point and three points in between.
- * Numbering of points is required in the construction.
- * Dimensions are not required.

DIDACTICAL GUIDELINES

- * Models and wall charts should be used to assist the students to develop the necessary insight and spatial perception.

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REPUBLIC OF SOUTH AFRICA

SYLLABUS

ENGINEERING DRAWING

N3

CODE NUMBER: 08090283

DATE OF IMPLEMENTATION
AUGUST 1996

DATE OF FIRST EXAMINATION
NOVEMBER 1996

ENGINEERING DRAWING N3

1. SUBJECT AIMS

1.1 GENERAL AIMS

1.1.1 The student must be able to

- * identify the function of engineering drawing in the engineering industry; and
- * interpret engineering drawing as an accurate and meaningful manner of communication, since drawing is the language used in the engineering industry.

1.1.2 The student must develop insight and spatial perception to perceive three-dimensional objects from two-dimensional representations.

1.1.3 The lecturer must convey the subject content in such a manner that it will awaken appreciation in the student for the subject.

1.1.4 The lecturer must integrate with the students' overall training and support the teaching and learning of the other instructional offerings.

1.2 SPECIFIC AIMS

The student must

- * be able to analyze and synthesize given views and drawings of engineering components;
- * be equipped with knowledge and skill concerning the following content: free-hand drawing of engineering components; isometric projection and perspective drawing; sectional drawing of machine parts; assembly drawing; and detail drawing.

2. DURATION OF INSTRUCTIONAL OFFERING

Full-time: One Trimester

Part-time: One Trimester

3. EVALUATION

Continuous evaluation

Class tests must be conducted continuously.

3.2 Pass requirements

The candidate must obtain at least 40% in the examinations to pass the instructional offering.

3.3 Examination paper

One four hour closed-book examination paper will be set.

4. EXAMINING

The level of difficulty related to knowledge, skill, comprehension, application, analysis and synthesis is important and should be as follows:

KNOWLEDGE AND SKILL	COMPREHENSION AND APPLICATION	ANALYSIS AND SYNTHESIS
± 35%	± 35%	± 30%

5. GENERAL INFORMATION

5.1 All drawing work must be done in accordance with the latest issue of the SABS 0111, Code of Practice for Engineering Drawing.

5.2 Drawings must be produced and evaluated with emphasis on the following elements:

- * Correctness
- * Linework
- * Speed
- * Accuracy
- * Balanced layout and neatness

5.3 All drawings, including machining symbols, must be done with drawing instruments. The only exceptions being printing, free-hand drawing and the C-type line/break line.

- 5.4 All printing must be done in pencil according to the SABS 0111 Code of Practice, either free-hand or by using a stencil. Printing must be neatly executed in order to improve the quality of the drawing.
- 5.5 When drawings are required to be made according to first or third angle orthographic projection, only the primary views will be given or asked.
- 5.6 The correct subject terminology must be used throughout.

6. LEARNING CONTENT

6.1 The modules for ENGINEERING DRAWING N3 consist of the following:

MODULE	DESCRIPTION	WEIGHT VALUE(±)
1	Free-hand drawing of engineering components	(10)
2	Isometric projection and perspective drawing	(15)
3	Sectional drawing of machine parts	(25)
4	Assembly drawing	(30)
5	Detail drawing	(20)
TOTAL		(100)

6.2 The weight value (WV) of a module

- * gives an indication of the percentage of the total content of the work which is occupied by the module;
- * gives an indication of the percentage of the time available for the instruction offering, which is to be spent on the module; and
- * gives an indication of the percentage of the total of marks of the examination paper, which is to be allocated to the module.

7. DETAILED SYLLABUS

MODULE 1: FREE-HAND DRAWING OF ENGINEERING COMPONENTS (WV 10)

On completion of this module the student must be able to draw free-hand and in good proportion given views of the following engineering components:

- | | |
|-------------------------------------|-----------------------------|
| * Spur gears in mesh | * Cotter and knuckle joints |
| * Square threads | * Piston and crank shaft |
| * Helical springs (round or square) | * Crosshead |
| * Cam with knife or roller follower | * Flange coupling |
| * Universal coupling | * Muff coupling |
| * Flexible coupling | * Pedestal bearing |
| * Footstep bearing | * Collar bearing |
| * Ball and roller bearing | * Simple braking system |
| * Centrifugal clutch | * Plate clutch. |
- * Lubricating devices (gravity feed, syphon wick, sight feed, needle lubricator, oil-ring lubricator, splash feed and force feed).

The following must be considered

- * Views may be given in first angle orthographic projection, third angle orthographic projection or as an isometric drawing

DIDACTICAL GUIDELINES

- * Students should be given a brief explanation of the function of each component before commencing a drawing in the classroom.

MODULE 2: ISOMETRIC PROJECTION AND PERSPECTIVE DRAWING (WV 15)

On completion of this module the student must be able to

2.1 draw an isometric projection of a single item of which at least two views are given, either in first-angle or third-angle orthographic projection. The following must be considered:

- * The isometric scale must first be constructed and then used to draw the isometric projection.
- * Isometric circles and arcs are drawn as ellipses and parts of an ellipse respectively, using the four-centre method of construction.
- * Non-isometric lines of an object are drawn at any given angle.
- * Hidden detail of essential detail may be required.
- * Centre lines may be required.
- * Interpenetrations and fillet radii are not to be included in this module.
- * No dimensions are required.

2.2 draw a one-point and two-point perspective view of a single component. The following must be considered:

- * The picture plane, left vanishing point, right vanishing point, horizon line, centre of vision, ground line, station point, height of eye above the ground line, distance of the eye in front of the picture plane, measuring point for the centre of vision.
- * The object must be on the ground line, up against the picture plane and in line with the centre of vision.
- * No circles or arcs will be asked.

DIDACTICAL GUIDELINES

- * Models, wall charts as well as clay or modelling wax, can be beneficially used to assist the student in visualizing and developing the correct necessary insight.

- * Free-hand isometric projection, using isometric grids should be used to develop skills in this section of the module.

MODULE 3: SECTIONAL DRAWING OF MACHINE PARTS

(WV 25)

On completion of this module the student must be able to draw the primary orthographic views of machine parts according to scale in first or third angle orthographic projection. The following must be considered:

- * Single or multi-part components may be required.
- * Multi-part components may have a maximum of eight components (fasteners excluded).
- * Multi-part components must be given assembled.
- * Sectional views to include, full, half, partial, revolved and removed sections.
- * Outside views may be required.
- * Machine parts with interpenetration curves and fillet radii may be required.
- * Only the starting point and end point need be determined for interpenetration curves larger than 5 mm on the drawing in this module. These points must then be joined using a flexi-curve or french curve template.
- * Conventional representation of drilled and tapped holes, bolts, nuts and studs is required.
- * Instructional notes, eg internal and external chamfering, spotfacing, counterboring, countersinking, drilling and tapping specification, may be required.
- * Machining and surface texture symbols are required and include the following:
 - removal of material by machining
 - removal within a limit
 - removal between a high and low limit
 - production method
 - sample length
 - machining allowance
 - no machining
 - no machining with a limit
 - method to avoid repeating a symbol
- * Limits and fits are required, (students may be supplied with tables and can be expected to use the applicable tables and to insert the tolerances in micro-metres converted to millimetres

on the drawing).

- * Drawings to a scale of: 1:1, 1:2, 1:5, 1:10 and 2:1 may be required.
- * Hidden detail may be required in parts that are not in section.

DIDACTICAL GUIDELINES

- * Note should be taken of all parts that are not sectioned in their length including ribs, webs, shafts, spokes pins and fastening devices etc.
- * Cutting planes lines are short chain lines suitably thickened at the ends (refer to SABS 0111, Code of Practice for Engineering Drawing).
- * Refer to the latest copy of the SABS 0111, Code of Practice for Engineering Drawing and the additional Code of Practice for Engineering Drawing at technical colleges.
- * Use various models and wall charts to assist with the visualization and to develop the necessary insight.
- * Note should be taken of the correct angle and spacing of the sectional lines, (45 degrees is accepted as the norm, unless otherwise required).
- * Hidden detail is not shown on views that are in section unless it is absolutely necessary.

MODULE 4: ASSEMBLY DRAWING

(WV 30)

On completion of this module the student must be able to

- 4.1 draw the assembly of the components from the given detail drawings.
- 4.2 draw the primary views of the assembly, according to scale, in either first-angle or third-angle orthographic projection.
- 4.3 draw sectional or outside views of assemblies.
- 4.4 use the following correctly on the assembly drawings:
 - * Item numbers and parts lists.
 - * Hidden detail.
 - * Conventional representation of bolts, nuts, studs and drilled and threaded holes.

The following should be considered:

- * Sectional views to include, full, half, partial, revolved and removed sections.
- * A maximum of 10 items may be given, (bolts, nuts, studs, pins, and other fastening devices excluded).
- * Fastening devices will not necessarily be shown on the diagram sheet but will be referred to in the item list.
- * A nut and bolt template may be used.
- * Draw to a scale of : 1:1, 1:2, 1:5, 1:10 or 2:1.

DIDACTICAL GUIDELINES

- * Models, wall charts should be used to assist the student to visualize and develop the correct insight.
- * Items that are not sectioned in their length, ie fastening devices, pins, shafts, spokes, ribs, webs etc.
- * Isometric exploded views, showing how the parts fit together, should be used in the presentation of this module to develop the skills of insight, analysis and synthesis.

MODULE 5: DETAIL DRAWING

(WV 20)

On completion of this module, the student must be able to

- 5.1 draw the required detailed parts of a given assembly drawing.
- 5.2 draw the primary views in first-angle or third-angle orthographic projection, of each specified separate item (part).

The following should be considered

- * Sectional as well as outside views are required.
- * Sectional views to include, full, half, partial, revolved and removed sections.
- * A maximum of 10 items may be given in an assembly (fasteners excluded).
- * Machining and surface texture symbols as well as ISO limits and fits and instruction notes may be required.
- * Conventional representation of drilled and tapped holes, as well as specially manufactured bolts and nuts is required.
- * Hidden detail may be indicated on parts not in section.
- * Dimensioning and printing of the title and scale may be required.
- * Draw to scale of: 1:1, 1:2, 1:5, 1:10 or 2:1.

DIDACTICAL GUIDELINES

- * Students should be encouraged to use models to physically assemble and dismantle multi-item machine parts.

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