

REPUBLIQUE DU CAMEROUN

Paix – Travail – Patrie

MINISTERE DES ENSEIGNEMENTS SECONDAIRES

DELEGATION REGIONALE POUR LE NORD-OUEST

INSPECTION REGIONALE DE PEDAGOGIE CHARGEE
DES TECHNIQUES INDUSTRIELLES

CONSTRUCTION MECANIQUE

REPUBLIC OF CAMEROON

Peace – Work – Fatherland

MINISTRY OF SECONDARY EDUCATION

REGIONAL DELEGATION FOR
THE NORTH-WEST

REGIONAL INSPECTORATE OF PEDAGOGY IN
CHARGE OF INDUSTRIAL TECHNIQUES

MECHANICAL DESIGN

SCHEME OF WORK FOR ENGINEERING DRAWING

👉 *INTERMEDIATE TECHNICAL & VOCATIONAL EDUCATION*

(ITYE)

OCTOBER 2020

FORM I:

ELECTRICAL ENGINEERING TECHNIQUES (EET1)

GENERAL OBJECTIVE

This course aims at giving to the students the following aptitudes:

- To manipulate the drawing instruments or tools in order to draw geometrical and curved simple forms;
- To use (with precision and cleanliness) and to interpret conventions of representation in Technical drawing
- To analyse simple mechanical assemblies and to bring out the global functioning and the functioning of each part.

Weekly hours: 4 hrs

**Prerequisite: Class VI (six)
Acquisitions**

PERIOD		ELEMENTS OF COMPETENCE <i>At the end of this lesson, the student will be able to:</i>	ELEMENTS OF CONTENTS		EVALUA- TION	RECOMMANDATIONS
			THEORETICAL CONTENTS	PRACTICAL CONTENTS		
1 st SEQUENCE	WEEKS N°1 & 2	- Say the need for the technical drawing and enumerate the various types of drawing; - Name and use the drawing tools; - Say the use of standardization	1 GENERALITIES ON TECHNICAL DRAWING		Oral and practical	Take care that each student has all the requested tools
			- Use of the technical drawing; - Different types of technical drawing; - Drawing instruments and use; - Standardization in technical drawing;	- Presentation of each instrument and use; - Drawing of lines: //, $\perp$ and oblique with specific angle		
	WEEKS N°3 & 4	- Define the scale - Enumerate the various types of scale with applicability; - Determine full dimensions and dimensions on the drawing;	2 SCALE OF A DRAWING		Oral and practical	
			- Definition and goal; - Type of scales; - Calculation of full dimensions and the dimensions on the drawing;	Calculation work of dimensions starting from a scale;		
		- Describe letterings used in Engineering Drawing; - Carry out a standardized lettering	3 STANDARD LETTERING		Oral and practical	
	- Importance of lettering; - Different types of lettering; - Size and dimensioning of letters;	Procedure for lettering (lower case letters and capital letters) and numerals				
5	Apply acquired knowledge	4 EVALUATION			Writing	
6		5CORRECTION OF THE EVALUATION				Establish the marking objective
2 nd Sequence	WEEK N°7	- Name and to indicate the use of the various types of lines - Recognize the various lines on a technical drawing - Carry out and to plot lines	6 LINES		Oral and practical	
			- Generalities on lines; - Types of lines and their applications; - Precedence of lines;	Handling of the drawing instruments and plotting various types of lines		

PERIOD		ELEMENTS OF COMPETENCE <i>At the end of this lesson, the student will be able to:</i>	ELEMENTS OF CONTENTS		EVALUATION	RECOMMANDATIONS
			THEORETICAL CONTENTS	PRACTICAL CONTENTS		
	WEEKS N°8	-Enumerate and dimension the various formats of Drawing; - Prepare a drawing sheet A4 format; -Plot the title block -Prepare a parts list area	7 PRESENTATION OF DRAWINGS		Oral, practical and writing	For home work, ask for the preparation of a drawing sheet which will be used for a future evaluation
			-Standard drawing sheets; - The frame; - Permanent graphic elements; - Block title; - Parts list	Handling of the instruments to carry out various plotting and lettering for the preparation of a drawing sheet A4 format		

2 nd SEQUENCE	WEEKS N°9 & 10	-Enumerate, define and plot the graphic elements of dimensioning; - Carry out the dimensioning of a simple figure; - Interpret a dimensioning.	8 DIMENSIONING		Oral and practical	- To study a case of dimensioning a prismatic shape, a case of a revolution shape and a case of angles. - To use as supports drawings of simple shapes
			- Aim; - Graphic elements of dimensioning - Examples of dimensioning (Execution of dimensions)	- Tutorial on dimensioning		
	11	Apply acquired knowledge	9 EVALUATION		Writing	
	12		10 CORRECTION OF THE EVALUATION			Establish the marking objective
3 rd SEQUENCE	WEEKS N°13 & 14	- Plot a straight line parallel on a reference line; - Plot a perpendicular on a reference line; - Divide a segment	11 GEOMETRICAL CONSTRUCTIONS: STRAIGHT LINES AND BROKEN STRAIGHT LINES		Oral and practical	- The elements to connect must be on hard copies and distributed to students who will have to only supplement; - The exercises to be done must be presented on hard copy distributed to

			- Relative position of straight lines; - Definition of a broken straight line; - Dividing a broken straight line into any number of equal parts - Perpendicular bisector of a broken straight line;	Handling of the instruments to plot: - Parallel and perpendicular straight lines; - Segments of straight line; - Perpendicular bisector of the segments; - The perpendicular to a line passing through a point		students
3 rd SEQUENCE	WEEKS 15 & 16	- Plot an angle using instruments; - Plot a triangle using instruments; - Plot the median and the bisector of a triangle; - Determine an angle of a triangle, knowing the others	<i>12 GEOMETRICAL CONSTRUCTIONS: ANGLES AND TRIANGLES</i>			Oral and practical For geometrical constructions, take care that each student has his material.
			- Drawing of angles; - Drawing of triangles; - Perpendicular bisector and angle bisector of a triangle; - Sum of angles of a triangle.	- Handling of the instruments to plot angles and triangles, medians and bisectors of a triangle; - Calculate one of the angles of a triangle.		
	17	Apply acquired knowledge	<i>13 EVALUATION</i>	Writing		
	18		<i>14 CORRECTION OF THE EVALUATION</i>			Establish the marking objective

4 th SEQUENCE	N°19	- Define the various quadrilaterals - Construct the various quadrilaterals - Define and plot a diagonal	15 GEOMETRICAL CONSTRUCTIONS: QUADRILATERAL	- Regular quadrilateral; - Unspecified quadrilateral.	Handling of the instruments to plot quadrilaterals	Oral and practical	
	WEEKS N° 20, 21 & 22	- Plot a circle; - Plot an inscribed circle in a square - Plot a circumscribed circle to a square; - Define and plot a pentagon, a hexagon and an octagon.	16 GEOMETRICAL CONSTRUCTIONS: CIRCUMFERENCE AND REGULAR POLYGONES	I/- CIRCLE - Definition - Incircle in a square; - Circumscribed circle to a square; - Chord of a circle; II/- REGULAR POLYGONS 1 Pentagon 2 Hexagon 3 Octagon	- Handling of the instruments to plot circumferences - Handling of the instruments to plot regular polygons	Oral and practical	The consolidation exercises will be elaborated on the base of simple drawings drawn from the professional environment of the trade
	23	Apply acquired knowledge	17 EVALUATION			Writing	
	24		18 CORRECTION OF THE EVALUATION				Establish the marking objective
	WEEK N° 25 & 26	- To build a circumference or an arc of circumference; - Plot the centre of an arc of circumference; - Plot the tangent or the secant to a circle; - Plot the common tangent to two circumferences	19 GEOMETRICAL CONSTRUCTIONS: ARCS OF CIRCLES, RELATIVE POSITION OF A CIRCLE AND A STRIGHTLINE	- Arc of circle of given centre and radius; - Centre of a given arc of circle; - Centre of an arc of circle passing through three given points; - Relative position of a straight line and a circle (tangent, chord).	Construction with instruments of: - A circumference - The centre of an arc of circumference - Tangents and secants to a circle.	Oral and practical	
5 th SEQUENCE	27	- Define a connection of two lines; - Connect two lines by a circumference of given radius; - Connect a circumference and a line by a circumference of given radius.	20 GEOMETRICAL CONSTRUCTIONS: CONNECTING TWO LINES, A LINE AND A CIRCLE	- Connecting two straight lines; - Connecting a straight line and a circle;	Construction of studied connections	Oral and practical	- The elements to connect must be on hard copies and distributed to students who will have to only supplement;

6 th SEQUENCE	WEEK N°28	- Connect two circumferences by a line; - To connect two circumferences by a circumference of given radius.	21 GEOMETRICAL CONSTRUCTIONS: CONNECTING TWO CIRCLES		Oral and practical	- The exercises to be done must be presented on hard copy distributed to students - The work will consist to supplement by required connections
			- Connecting two circles by a straight line; - Connecting two circles by a circle of given radius.	Construction of studied connections		
	29	Apply acquired knowledge	22 EVALUATION		Writing	
	30		23 CORRECTION OF THE EVALUATION			
	31		24 REPRESENTATION OF PARTICULAR SHAPES		Oral and practical	The work consists of exercises on the simple objects drawn from the school environment
			Free hand sketch	- To plot regular hatches; - To represent different materials		
	32 & 33		25 GENERAL REVISION			

FORM II

EQEL/ELNI/ACRE

Statement of the competence: To exploit a Technical drawing

Module title: ENGINEERING DRAWING

Level of study: Form 2 EQEL/ELNI/ACRE

Minimum weekly load: 04Hrs

Minimum annual load: 88Hrs

PERIOD		Elements of the competence	Elements of contents	Evaluation Indicators	Teaching recommendations
1 st SEQUENCE	Week N°1	To dimension a simple part	Shape dimensioning - Dimensioning of prismatic shapes - Dimensioning of revolution shapes - Dimensioning of angles;	- Dimension a geometrical pattern - Interpret the dimensioning of a geometrical pattern	An exercise from a perspective and another from incomplete views
	Week N°2	To represent a simple part in orthogonal projection	Oblique projection - Cavalier perspective (referential of projection, characteristics of a cavalier perspective) - Cavalier perspective of a prismatic shape) - Cavalier perspective of revolution shapes - Axonometric perspective (Different types) - Isometric perspective.	- Interpret the characteristics of a cavalier perspective - Execute the cavalier perspective of a simple prismatic shape - Draw an ellipse with given characteristics - Execute the cavalier perspective of simple revolution shapes - Execute the isometric perspective of a simple technical object - Name the projection method - Indicate the orthogonal projection planes;	

2nd SEQUENCE	Week N°3 & 4	To represent a simple part in orthogonal projection	Orthogonal projection - Projection plan - Projection methods - Projection of a cube - Page layout - Correspondence between views - Orthogonal Projection of solid with prismatic shape (parallelepiped, pyramid) - Orthogonal projection of revolution shape (Cylinder, cone, sphere) - Orthogonal projection of a complex solid	- Identify the different views of a piece in a cube; - Execute the page layout - Represent a parallelepiped and a pyramid in 3 views; - Represent a simple revolution shape in 2 views; - Represent details by the types of suitable lines; - Execute a correct page layout; - Use the correspondence principles to represent a detail on all the views - From the nature of lines decode the view details - Identify and name the geometrical shapes of surfaces and volumes of a piece	
	5	To apply acquired knowledge	<i>EVALUATION</i>		
	6		<i>CORRECTION OF THE EVALUATION</i>		
	Week N°7		Representation of pieces out of simple cut - Principle - Cutting plane - Execution method of a cut; - Hatchings	- Plot a cutting plane; - Execute the section of a piece with simple shape	- Start from a cylinder with many different sections - For each case, give the aim, the execution method and study an example;

	Week N°8	Represent/ Interpret a simple piece from a functional mechanism (continuation and end)	Representation of a section of a piece - Principle - Cutting plane Different types (Removed section, revolved section)	- Interpret the drawing details of the section of a piece; - Establish the difference between a sectional view and a section; - Interpret the drawing details of the section of a piece; - Execute the section of a simple piece.	- The surfaces are represented on a sheet of paper to be distributing to student. The students just follow the teacher on the board and construct the intersection. - For each case indicate the auxiliary surfaces used. - Construct 4 points by case and plot the curve.
	Week N°9		Intersection of two surfaces - Cylindrical surfaces and plane surfaces -Cylindrical surfaces with perpendicular axis (solid cylinders with the same diameter, solid cylinders with different diameters, holes with the same diameter holes with different diameters, solid cylinders and cylindrical hole). - Spherical surface and plane surface; - Spherical surface and revolution surface	- Identify (read) the representation of the intersection of a cylinder and a plane on a drawing; - Identify (read) the representation of the intersection of two cylinders on a drawing; -Identify (read) the representation of the intersection of a sphere and a plane on a drawing; - Identify (read) the representation of the intersection of a sphere and another revolution surface on a drawing; - Represent the intersection of a cylinder and a plane in different views; - Represent an intersection of two cylinders in different views.	
	Week N°10		Shape vocabulary Chamfer - flat – boss – counter bore – dovetail-groove – rib – knurling – undercut – fillet – shoulder- hole - etc.	- Identify a shape detail on a mechanical piece; - Give the function of a shape detail; - Represent a shape detail; - Interpret the technical vocabulary relating to the shapes	
	11	To apply acquired knowledge	<i>EVALUATION</i>		
	12		<i>CORRECTION OF THE EVALUATION</i>		

3rd SEQUENCE	Week N°13	To identify and to interpret the mechanical linkages	Mechanical linkages - Degree of freedom of a solid - Definition of a linkage - Characteristics of a linkage - Mode of linkage Mechanical assembling - Technological analysis of an assembly - Notion of functional condition - Notion of functional surface - Notion of functional dimension	- To enumerate the possible movements of a part in the Euclidian space - To identify the degrees of freedom in a linkage - To enumerate the characters of the mechanical connections; - To give the mode of a linkage	- The first analyse of each linkage will permit to the students to indicate the condition and functional surfaces
	Week N°14 & 15		Non dismountable complete links 1- Welding linkage - Representation of a weld bead - Assembly of two pieces to weld - Examples 2- Riveting linkage - Assembly of two pieces to rivet - Riveting - Examples 3- Gluing linkage - Gluing representation - Examples 4- force fit linkage - Pieces assembling - Examples	- Identify a weld bead on a plan; - Identify a rivet; - Indicate the other characteristics of a non-dismountable complete link; - Give at least three types of non-dismountable complete link;	- Analyze each assembly to remove the functional surfaces and the kinematic constraints by link; - came out the character of obtained link; - Give to students a sheet of paper with an examples of the studied link

	Week N°16		SCREW-NUT SYSTEM - Definition - Description and representation of screw and nut system - Functioning of screw and nut assembly - Using of screw and nut system (movement transmutation, Complete links, partial links)	- Define a screw-nut system; - Describe and represent a screw, a nut; - Define the pitch of a screw and the pitch of a nut; - Determine experimentally the pitch of a screw and the pitch of a nut - Give at least two using examples of the mechanism - Describe the movement transformation by screw-nut system	
	17	To apply acquired knowledge	EVALUATION		
	18		CORRECTION OF THE EVALUATION		
4 th SEQUENCE	Week N°19	To identify et interpret the mechanical links (continuation)	Complete dismountable linkages by tap screw - Principle - tapped hole - Realisation of the linkage - improvement devices of the linkage - Washer (function, different types, standard designation) - Lock screw (function, different types)	- Identify a tap screw, a washer and a lock screw on a plan - Give the role and standard designation of a tap screw - Identify a washer or a lock nut; - Represent a tapped hole; - Describe a complete link by tap screw	
	Week N°20		Complete dismountable linkages by set screw And stop screw - set screw (role, different types, realization of linkage, standard designation) - stop screw (role, different types, realization of linkage standard designation)	- Identify a set screw and a stop screw on a plan - Give the standard designation of a set screw or a stop screw; - Give the role of a set screw and a stop screw; - Describe a complete link of two pieces by a set screw or a stop screw;	

5 th SEQUENCE	Week N°21		Complete dismountable linkages by studs and bolts - Studs (Description and representation, role, standard designation, realization of linkage) - Bolts (definition, description, representation, role, different types, standard designation, realization of linkage) - improvement of the linkage by lock nut	- Define a bolt; - Identify a stud or a bolt on a plan; - Identify a lock nut - Give the role of a stud or a bolt - Give the standard designation of a stud or a bolt - Describe a complete linkage of two pieces by a stud or by a bolt	designation - A sheet of paper to be distributed to the students must have for each type of linkage the sketch of the different pieces which the student will complete with the functional surfaces at level of linkage - The first analyze of each linkage will permit to the students to indicate the condition and functional surfaces
	Week N°22	To identify et interpret the mechanical links (continuation)	Complete dismountable linkages by smooth part: Pinning - The pins (for each type, role, representation, standard designation) - Complete links by pin	- Identify a pin on a plan; - Give the role of a pin in a linkage; - Give the standard designation of a pin; Describe a complete linkage of two pieces by a pin	
	23	To apply acquired knowledge	EVALUATION		
	24		CORRECTION OF THE EVALUATION		
	Week N°25	To identify et interpret the mechanical links (continuation and end)	Partial linkage with freedom in translation between two pieces - Direct linkage by splines; - Linkage by parallel key or woodruff key - Linkage by guide screw.	- Identify a partial linkage with freedom in translation; - Describe a partial linkage with freedom in translation; - Give the standard designation of a parallel key, of a woodruff key, of a guide screw.	

	Week N°26		Partial linkage with freedom in rotation between two pieces (by a stop element on shaft) - Partial linkage by retaining ring (Circlips, snap rings); - Partial linkage by locking ring - Partial linkage by cotter pin; - Partial linkage by snap ring; - Partial link by guide screw.	- Identify a stop element on a pin; - Give the role of a stop element on a pin in a linkage - Give the standard designation of a stop element on a pin; - Describe a partial link with freedom in rotation between two pieces	
	Week N°27		Elastic link - Principle; - Example of realization - Representation of springs (different type with their function and usage sample) - Mounting of compression springs or traction spring - Mounting of spiral spring	- Identify an elastic link on a plan; - Describe an elastic link. - Identify a spring in a linkage; - Give the role of a spring in a linkage; - Represent a spring	- Evoke verbally the leaf springs
	28		REVISION		
	29	To apply acquired knowledge	EVALUATION		
	30		CORRECTION OF THE EVALUATION		

FORM III

EQEL/ELNI/ACRE

Statement of the competence: To exploit a Technical drawing

Module title: **ENGINEERING DRAWING**

Level of study: Form 3 EQEL/ELNI/ACRE

Minimum weekly load: 04Hrs

Minimum annual load: 88Hrs

PERIOD		Elements of the competence	Elements of contents	Evaluation Indicators	Teaching recommendations
1 st SEQUENCE	Week N°1	To represent/ To interpret a simple piece from a functional mechanism	Representation of parts in specific sections - Half section; - Partial section; - Section in two non-parallel planes.	- Plotting a cutting plane; - Realize the section of a piece with simple shape; - Interpret drawing details; - Represent details according to the appropriate type of lines;	- The object to cut must have inside forms. It must be presented in perspective on a paper format to be distributed to the students;
	Week N°2, 3		Representation of specific views - Partial view; - View of symmetric objects; - offset section; - Representation of close parts; - Representation of a fictitious edge	- Decode view details base on the nature of lines - Identify a half view, an offset section of an object ... - Realize a half view, an offset section of an object - Decode a representation of close part; - Identification of a fictitious edge of a technical object. - Represent a fictitious edge of a technical object. - Interpret a fictitious edge	- The starting views for the particular representations must be reproduced on a paper format to be distributed to the students who will have to only supplement;
	Week N°4		Specific representations - Method of marked arrows; - Tipping-up; - Details in front of the cutting plane.	- Indicate the view direction; - Represent a marked view of a piece; - Represent the tipping-up of a view; - Interpret a detail located in front of the cutting plane, brought back in this plane; - Represent on the cutting plane, a detail located in front of this plane.	- The starting views for the particular representations must be reproduced on a paper format to be distributed to the students who will have to only supplement;
	5	To apply acquired knowledge	EVALUATION		

	6		<i>CORRECTION OF THE EVALUATION</i>		
	Week N°7		Quarter section of perspectives - Aim; - Procedure.	- Read a perspective 1/4 removed - Carry out a perspective 1/4 removed of a simple part	
2 nd SEQUENCE	Week N°8		Intersection of surfaces - Conical surface and plane surface; - Conical surface and cylindrical surface.	Identify (Read) the representation of the intersection of a cone and a plane on a drawing; - Identify (Read) the representation of the intersection of a cone and a cylinder on a drawing;	
	Week N° 9, 10		Assembly drawing - Identification of the elements of a mechanism (parts list, hatches, etc.) - Borders of a part of a mechanism - Concept of group of parts - Global function of a unit - Basic Function of a part or a group of parts;	Delimit a part in an assembly drawing; - Identify and delimit a functional group; - Determine the global function of a unit; - Determine the basic function of a part or a group of parts of a unit; - Identify the linkage between two parts; - Exploit the FAST diagram (Function Analysis System Technic) relative to a given mechanism;	- The support plan to be distributed to the students is an assembly drawing of 3 or 4 main parts; - Require that each student has different colour pencils; - The technological analysis will pass by the interpretation of the description of the mechanism represented on the assembly drawing to bring out: • The global function; • Functional conditions; • Possible movements of a part or a group of parts; • Basic functions - Insist on the relation between design and manufacture; - Insist on the number of views necessary and sufficient to determine a part completely;

11	To apply acquired knowledge	<i>EVALUATION</i>		
12		<i>CORRECTION OF THE EVALUATION</i>		
Week N° 13, 14	To identify and to interpret a mechanism from the functional point of view	Functional dimensioning - Dimension condition or functional clearance - Need for functional dimensioning - Terminal Surfaces and bearing surfaces - Minimal Chain of dimensions - Dimensioning a detail drawing	- Decode a chain of dimensions; - Calculate the dimensions of a minimal chain; - Carry out a chain of dimensions; - Interpret the functional dimensioning of a detail drawing; - Carry out a functional dimensioning; - Set up a functional dimension on a detail drawing	- Take the examples of cones and oblique surfaces in the workshop; - The assemblies used must be reproduced on a paper format to be distributed to the students; - Explain the compatibility of the dimension condition with the component dimensions (exploitation of the relation between the IT of a chain of dimensions).
15		Dimensional tolerance - Concept of interchangeability; - tolerance dimension (tolerance range); - Standardized deviations	- Set up a tolerance dimension; - Interpret a tolerance dimension; - Read the table of deviations;	
Week N°16		Fits - Standardized fits - Choice of a fit - Detail dimensioning of a part participating to a fit - Calculation of an allowance in a fit.	- Define a fit; - Indicate the various systems of fit; - Choose a fit; - Dimension a fit; - Calculate the allowance of a fit;	Take care that each student equips himself for this lesson, with an authorized dimensional documentation for the official examinations;
17	To apply acquired knowledge	<i>EVALUATION</i>		
18		<i>CORRECTION OF THE EVALUATION</i>		

4 th SEQUENCE	Week N°19 & 20		Choice of material: notion of friction - Highlighting of the phenomenon of friction between two surfaces - Coefficient of friction between two materials (definition, example) - Choice of the materials (materials of friction, antifriction materials) - Disadvantages of friction - Fight against wear by surface treatment.	- Describe some manifestations of friction; - Interpret the coefficient of friction between two materials; - Quote two disadvantages of friction; - Justify the choice of a material in a linkage; - Give two examples of use of friction; - Quote a surface treatment fighting against wear.	- Present a nuance of each current material. - Insist on the conducting character (or insulating) thermal or electric
	Week N°21	To identify and to interpret a mechanism from the functional point of view	Lubricating function - Aim of lubrication; - Lubricants (character, typology); - Lubrication modes; - Devices of lubrication (with oil, grease).''''	- Give the goals of lubrication; - Enumerate the characteristics of a lubricant; - Quote at least three lubricants used in the trade; - Identify a device of lubrication;	- The students should not draw the devices - The support plan to be distributed to the student be an assembly drawing comprising some device analysed. - This plan can be the same one for the two lessons
	Week N°22	To identify and to interpret a power transmission device between two shafts	Sealing function - Goal of the sealing; - Typology of the sealing; - Static sealing devices (direct, indirect); - Dynamic sealing devices (direct, indirect).	- Give the goal of sealing; - Quote the various types of sealing; - Identify a device of sealing.	- The students must establish by a show of hands the sketches of the main parts of each studied coupling.
	23	To apply acquired knowledge	<i>EVALUATION</i>		
	24		<i>CORRECTION OF THE EVALUATION</i>		

5 th SEQUENCE	25		REVISION	
	26		REVISION	
	27		REVISION	
	28		REVISION	
	29	To apply acquired knowledge	<i>EVALUATION</i>	
	30		<i>CORRECTION OF THE EVALUATION</i>	

FORM IV

EQEL/NI/ACRE

Statement of the competence: To exploit a Technical drawing

Module title: **ENGINEERING DRAWING**

Level of study: **Form 4 EQEL/ELNI/ACRE**

Minimum weekly load: 04Hrs

Minimum annual load: 88Hrs

PERIOD		Elements of the competence	Elements of contents	Evaluation Indicators	Teaching recommendations
1 st SEQUENCE	Week N°1	To identify and to interpret a guidance in a mechanism	Guidance in translation - Forms of guidance surfaces; - Guidance devices in translation; - Realization of a guidance in translation; - Improvement of a guidance in translation (wear clearance adjustment, use of linear ball bearing, linear needle bearing, ball bearing screw).	- Describe the various sections of the guidance in translation; - Identify the guidance devices in translation; - Describe the realization of a guidance in translation; - Describe an improvement device of guidance in translation;	- The examples studied are preferably selected on the existing machines in the workshop; - Insist on the guidance in translation by dovetail;
	Week N°2		Guidance in rotation with plain bearing - Typology of plain bearings (definition, various types); - Realization of a guidance in rotation with plain bearings; - Functional Conditions (axial clearance, radial clearance precision of clearance, surface roughness, span length); - Improvement of guidance (choice of materials, lubrication).	- Characterize a plain bearing; - Identify a bushing; - Identify the stopping devices in translation; - Indicate the functional conditions in a guidance in rotation; - Carry out the functional dimensioning of a guidance in rotation on plain bearings;	

1st SEQUENCE	Week N°3		Guidance in rotation: generalities on bearings - Bearing necessity - Constitution of a bearing; - Various types of bearing; - Standardized Designation of a bearing	- Describe the realization of a guidance in rotation on plain bearings; - Compare a guidance in rotation on bearing and a guidance in rotation on plain bearings (advantage and disadvantage); - Describe a bearing; - Identify a bearing or a thrust; - Give the standardized designation of a bearing; - Schematically represent a bearing or a thrust.	- Present a bearing to the students - The support plan to be distributed to the students represents a unit comprising at least two guidance in rotation with bearings; - This plan comprises the various bearings represented out of cut. The students must supplement to dimension by diagrams and efforts.
	Week N°4		Guidance in rotation: Mounting of deep groove ball bearings - Mounting of single row deep groove ball bearings - Mounting of double row angular contact ball bearings - Mounting of double row self-aligning ball bearings - Mounting of ball thrust	- State the mounting rules of bearings or thrust; - Identify the stopping devices in translation of the races/bearing rings in a guidance; - Set up the dimensioning of the journal bearings in a guidance; - Set up the functional clearance in a guidance in rotation with bearings; - Describe a device of clearance adjustment (wear in the journal bearing) in a guidance;	- For each bearing, give the characteristics being able to direct the choice and an example of field of application;
	5	To apply acquired knowledge	<i>EVALUATION</i>		
	6		<i>CORRECTION OF THE EVALUATION</i>		

2nd SEQUENCE	Week N°7		Guidance in rotation: Mounting cylindrical roller bearings and needle bearings - Mounting of cylindrical roller bearings; - Mounting of needle bearings – needle roller cage - drawn cup needle bearings; - Mounting of a needle thrust bearing		
	Week N°8 & 9	To identify and to interpret a guidance in a mechanism (continuation and end)	Guidance in rotation: Mounting of single row angular contact ball bearing and taper roller bearing - Mounting of taper roller bearing or single row angular contact ball bearing; - Wear take-up devices in the bearing race		- The support plan to be distributed to the students must contain the various cases of mounting to be analysed; - Following the analysis, identify the elements (rotating and fixe), plot the stopping diagram in translation and dimension the fits; - For each type of mounting, give the stopping rule in translation (disposition in “X”, in “O”)
	Week N°10		Bearing protection - Goal of the bearing protection; - Covers and caps; - Lubrication of bearings; - Sealing in the bearing mounting (case of grease lubrication, cases of oil lubrication, dust sealing, sealed bearings).	- Identify a protection device of bearings in a guidance; - Identify a lubrication device of bearings in a guidance; - Identify a sealing device in a guidance.	
	11	To apply acquired knowledge	<i>EVALUATION</i>		
	12		<i>CORRECTION OF THE EVALUATION</i>		

3rd SEQUENCE	Week N°13	To identify and interpret a power transmission device between two shafts	Motion or power transmission between two shafts - Need for the motion transmission between two shafts; - Transmission shafts; - Typology of the transmission system.	- Say the industrial need for the transmission of movement between two shafts; - Identify a transmission shaft; - Quote the types of motion transmission between two shafts;	- Distribute to the students the support plan comprising an example installed of each coupling to study - Study the vocabulary of the form details on a shaft;
	Week N°14		Rigid coupling between two shafts - Stress of relative positioning of the shafts to be coupled; - sleeve coupling; - Split Coupling - Flanged coupling - Sleeve of dilation	- Give the characteristics of a coupling between two shafts; - Identify a rigid coupling between two shafts in a plane; - Describe a rigid coupling between two shafts; - Give an advantage and a disadvantage of a rigid coupling between two shafts;	- For each coupling, study the other of mounting - dismounting; - Study a keyed sleeve coupling and a pinned sleeve; - The students must establish by a show of hands the sketches of the main parts of each studied coupling.
	Week N°15		Flexible or elastic coupling - Particularities; - Advantages; - Constitution; - Examples.	- Identify an elastic coupling between two shafts in a plane; - Describe an elastic coupling between two shafts; - Give an advantage of an elastic coupling between two shafts; - Compare the transmission by joint and the transmission by elastic coupling;	
	17	To apply acquired knowledge	<i>EVALUATION</i>		
	18		<i>CORRECTION OF THE EVALUATION</i>		

4th SEQUENCE	Week N°19		Power transmission by pulley and belt - Principle of the transmission; - speed ratio; - Condition of functioning; - Pulleys ($\neq$ parts, materials, examples); - Belts ($\neq$ types and materials); - Advantages and disadvantages; - examples of use	- Identify a transmission by pulleys and belt in a plane; - Exploit the report/ratio speeds; - Plot the kinematic diagram of a transmission by pulleys and belt; - Represent a pulley; - Give at least two examples of belt - Identify a transmission by pulleys and belt on a plan; - Exploit the transmission ratio; - Quote an advantage and a disadvantage of this transmission - Describe a solution of the linkages pulley-shaft; - Give an example of use of the transmission by pulleys and belt in industrial environment;	
	Week N°20		Power transmission by friction Wheel - Need; - Principle of the friction wheels; - Speed ratio; - Condition of functioning; - Advantages and disadvantages; - Examples of use.	- Identify a transmission by friction wheels on a plan; - Exploit the speed ratio; - Quote an advantage and a disadvantage of this transmission - Describe a solution of the linkages wheel-shaft; - Give an example of use of the transmission by friction wheels in industrial environment;	

5 th SEQUENCE	Week N°21	To identify and to interpret a power transmission device between two shafts (continuation)	Spur Gear drive - Definition and goal of gears; - Principle of transmission; - Elements of gear teeth - Condition of meshing of two gears; - Speed ratio. - Guidance of shafts - Examples of use	- Identify gears on a plan; - Give an advantage and a disadvantage of the gear drive compared to the transmission by pulleys and belt; - Enumerate the elements of gear teeth; - State the condition of meshing; - Exploit the speed ratio.	- There is no demonstration to make. All is stated. - Distribute a support plan containing gear drive
	22		REVISION		
	23	To apply acquired knowledge	EVALUATION		
	24		CORRECTION OF THE EVALUATION		
	25 to 28		REVISION		
	29	To apply acquired knowledge	EVALUATION		
	30		CORRECTION OF THE EVALUATION		

FORM V

EQEL/ELNI/ACRE

Statement of the competence: To exploit a Technical drawing

Module title: **ENGINEERING DRAWING**

Level of study: **Form 5** EQEL/ELNI/ACRE

Minimum weekly load: 04Hrs

Minimum annual load: 88Hrs

❖ **GENERAL COMPETENCES:**

This course aims at giving to the students the following aptitudes:

- ✓ Identifying and making a diagram of the various mechanical linkages, removable or simple permanent fastening devices;
- ✓ Defining the tolerances and fits relative to simple linkages;
- ✓ Identifying and indicating or decode the standard designation of mechanical construction materials;
- ✓ Identifying and indicate mechanical devices according to the standards of mechanical engineering;
- ✓ Carrying out by freehand and using conventional instruments, the plotting of lines and simple geometrical shapes;
- ✓ Carrying out orthogonal projections; associating lines of points and orthogonal projection surfaces;
- ✓ Carrying out by freehand and using instruments auxiliary sections and views.
- ✓ Interpretation of simple details on drawings, information of mechanical pieces such as dimensions, tolerances, various operations.
- ✓ Interpretation of simple assembly drawings.
- ✓ Carrying out in orthogonal projection, the dimensioned drawing of parts extracted from an assembly drawing.

PERIOD		Elements of the competence	Elements of contents	Evaluation Indicators	Teaching recommendations
1 st SEQUENCE	Week N°1, 2	- To define the concept of dimensioning; - To indicate the general principles of inscription and disposition of the dimensions of usual shapes - To identify the main symbols used in dimensioning - To dimension parts and their shapes in projection - To represent a piece at the scale	SIMPLE DIMENSIONING - Dimensioning elements ➤ Leader line; extension, dimension, - Inscription of values ➤ linear Values; Angular values - Specific dispositions: ➤ Dimensioning a chord, an arc, an angle; chamfers; a half-view ➤ Dimensioning radius and diameters; - Disposition of dimensions ➤ Chain dimensioning; parallel dimensioning ➤ Dimensioning with superposed dimensions ➤ Dimensioning in coordinates	- Exact Definition of the concept of dimensioning; - Exact Indication of the general principles of inscription and disposition of the dimensions of the usual shapes; - Good identification of the main symbols used in dimensioning - Good dimensioning of pieces and their shapes in projection - Good representation of a piece at the scale	- Starting from an example of piece or dimensioned mechanism, - Define the concept of dimensioning; - Identify the elements and the main symbols used in dimensioning - Indicate the general principles of dimensioning; - Dimension a piece, element of a mechanism - Represent a dimensioned piece at the scale

2 nd SEQUENCE	Week N°3,4	- To define the concepts of interchangeability of a mechanical part, of toleranced dimensioning and fit; - To identify and decode a tolerance and a fit; - To define, choose and indicate a toleranced dimension on a detail drawing of a mechanism	TOLERANCES AND FITS - Object of tolerances: - Dimensions ➤ Nominal sizes; effective Dimensions ➤ Limits of size - Deviations; Upper deviation; Lower deviation - Tolerance ➤ Position and quality of a tolerance ➤ Fundamental tolerances - Fits ➤ Definition; Types of fits ➤ Systems of fits - Use of the table of fit deviations	- Exact Definition of the concepts of interchangeability of a mechanical part, toleranced dimensioning and fit; - Good identification and decoding of a tolerance and a fit; - Exact Choice and good indication of a tolerance dimension on a detail drawing of a mechanism	<i>Starting from a real or virtual mechanism of the environment of the speciality and under the guidance of the teacher:</i> - Define the concepts of tolerances, fits and functional clearances - Classify the fits according to the allowance - Choose a fit and calculate the allowance - Dimension a fit on a drawing;
	5	To apply acquired knowledge	EVALUATION		
	6		CORRECTION OF THE EVALUATION		
	Week N°7, 8	- To identify threaded shapes in a simple mechanism - To represent a threaded rod and a tapped hole - To represent an assembly screw-nut - To dimension threaded shapes	THREAD & THREADED DEVICES - Generalities - Definition - Use; - Characteristics ➤ Nominal Diameter; Number of threads - Pitch; Helix direction; Thread profiles (metric ISO; round; Trapezoidal; square; dissymmetrical; in saw-toothed) - gas profile for tubes and connections - Representation of threaded mechanical parts ➤ Screw or threaded rod ➤ Tapped blind holes and through holes - Assembly of mechanical threaded parts	- Good identification of threads and tapings; - Good identification of a threaded shape the profile. - Respect of lines; - Respect of thread runouts - Respect of chamfers; - Accuracy of dimensions. - Respect of the ends of tapping; - Respect of thread and tapping reserves;	<i>From the examples of parts and threaded shapes,</i> - Define the concept of thread cutting; - Identify the characteristic elements of the threaded shapes - Represent the threaded shapes; - Identify the main used symbols - Indicate the general principles of dimensioning threaded shapes;

	Week N° 9, 10	- To identify and present the main mechanical construction materials; - To identify and introduce the main families of mechanical construction metals: Steels and cast irons; - To give the standardized designation of steels and cast irons - To indicate the general properties of steels and cast irons - To present and describe the main mechanical tests - To interpret test diagrams	DESIGNATION OF METALS & ALLOYS 1– Cast irons ▪ Bladed graphite cast iron ▪ malleable nodular graphite cast iron 2 – Steels ➤ Non alloy/carbon steels ▪ General purpose steel ▪ Casting-steels ▪ Drill steels ▪ Heat treatment steels. ➤ Alloy steels ▪ Low alloy steels ▪ High allow steels 3 – Nonferrous metals and alloys ▪ Non alloy Metal ▪ Alloys 4 – Copper and copper alloys 5 – Aluminium and aluminium alloys	- Good identification and presentation of the main mechanical construction materials; - Good identification and presentation of the main families of mechanical construction metals: Steels and cast iron; - Exact Standard Designation of steels and cast iron - Exact Indication of the general properties of steels and cast iron - Exact Presentation and good description of the main standardized mechanical tests - Good interpretation of test diagrams	<i>From the examples of real or virtual metals of the environment of the speciality,</i> - Identify and classify the main families of mechanical construction metals: Steels, cast iron - Describe the main mechanical construction materials; - Give the classes and the standardized designation of steels and cast iron - Criticize the general properties of steels and cast iron - Describe the main mechanical tests of materials and interpret the diagrams
	11	To apply acquired knowledge	EVALUATION		
	12		CORRECTION OF THE EVALUATION		

3 rd SEQUENCE	Week N°13, 14	- To indicate the principle of a section (full section, half-section, partial section, offset section and sections); - To indicate the standardized rules of the representation of a part in section (sectional views) - To realize a section on a part in perspective or projection - To identify and decode the standardized hatchings	SECTIONAL VIEWS FULL SECTION 1 - Goal; Definition and Principle 2 - Representation of a full section 3 - Hatchings ➤ Execution of hatchings ➤ Conventions of use 4 - Elements of a section and rules to retain 5 - Various sections ➤ partial sections; Half – sections ➤ Offset sections; Broken out sections SECTIONS 1 – Aim; Definition and Principle 2 – Removed section; 3 – Revolved section 4 - Elements of a section and rules to retain	- Exact Indication of the principle of section (Full section, half-section, broken out section, offset section, and sections); - Exact Indication of the standardized rules of the representation of a part in section (sectional views) - Good execution of a section on a part in perspective or projection - Good identification and decoding of the standardized hatchings	Starting from a real or virtual mechanism of the environment of the speciality, and/or assembly drawing in its position of use and under the guidance of the teacher: ➤ Observe, carry out and represent full sections, Half-sections, offset sections with parallel planes and broken out sections in orthogonal projection; ➤ Carry out the reading of the shapes out section in orthogonal projection; ➤ Observe, carry out and represent the sections in orthogonal projection;
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	Week N°14,15	- To represent the Intersections in orthogonal projection and axonometric perspectives • Plane - plane • Cylinder - plane • Cylinder - cylinder • cone - plan - To indicate the principle of projection and correspondence - To explain the principle of view reading and construction of a view from others known;	INTERSECTIONS 1 - Intersections Cylinder – plane ➤ Plane II axis of the cylinder ➤ Plane secant to the axis of cylinder 2 - Intersections of solids of revolution ➤ Methods of auxiliary planes. ➤ Methods of auxiliary spheres. 3 - Intersection cylinder - cylinder ➤ Cylinders of same diameter ➤ Intersection at 90 degree ➤ intersection # 90 degree 4 - Cylinders of different diameter ➤ Intersection at 90 degree 5 - Intersections of a cone and a Plane ➤ plan perpendicular to the axis of the cone ➤ Plane secant to the axis of the cone 6 - Intersections of planes	- Good representation of the intersections in orthogonal projection and in axonometric perspectives • Plane - plane • Cylinder - plane • Cylinder - cylinder • cone - plan - Exact Indication of the principle of projection and correspondence - Good explanation of the principle of view reading and construction of a view from others known;	Starting from a real or virtual mechanism of the environment of the speciality and under the guidance of the teacher: - Observe, explain and apply: ➤ principles of projection and recommendations for the choice of the views; ➤ Rules of view reading of drawing in orthogonal projection and use of the correspondences ➤ principles of axonometric projection - Represent parts with intersections in orthogonal projection and perspective;
	17				
	18		CORRECTION OF THE EVALUATION		

4th SEQUENCE	Week N°19, 20	- To represent a view or a fictitious position of a moving part - To indicate the principle of projection and correspondence - To explain the principle of the view reading and construction of a view from others known;	PARTICULAR REPRESENTATIONS - Extreme positions of moving parts. - Close Parts - Elements being ahead and behind of the cutting plane. - Half - folding back - Fictitious Edges and outlines	- Exact Representation of an auxiliary view or a fictitious position of a moving part - exact Indication of the principle of projection and correspondence - Good explanation of the principle of view reading and construction of a view from others known;	<i>Starting from a real or virtual mechanism of the environment of the speciality, Observe and identify:</i> - the particular views of a part - extreme position of moving parts - Fictitious Edges and outlines
	Week N°21, 22	- To give the standardized representation of welding; - To specify main weldable materials and the main methods of welding; - To describe the main fastening devices (Thread cuttings, Screwing, bolts, Rivets, Pins...) - To identify and give the standardized designation of the fastening devices	FIXED CONNECTION ORGANS - GLUE AND WELD ➤ Glues ➤ Welds - NON THREADED DEVICES ➤ Rivets; Pins ➤ Keys; Splines - THREADED ORGANS: ➤ Tap screw ➤ Nuts; Bolts ➤ Studs; set screw	- Good standardized representation of welds; - Exact Description of main weldable materials and the main welding methods; - Exact Description of the main fastening devices (Thread cuttings, Screwing, bolts, Rivets, Pins...) - Good identification and standardized designation of fastening devices	<i>Starting from a real or virtual mechanism of the environment of the speciality,</i> - Identify and give the standardized designation of a complete connection device - Graphically represent a complete connection device - Give the characteristic elements of a complete connection device supplements with the selection and mounting criteria.
	23	To apply acquired knowledge	EVALUATION		
	24		CORRECTION OF THE EVALUATION		

5 th SEQUENCE	Week N°25	- To represent a complete connection device in a mechanism - To identify in a mechanism, complete linkages and connection devices - To give the standardized representation and designation of a weld joint - To give the recommendations for the realization of welded joints as well as the main methods of welding	COMPLETE LINKAGES/ EMBEDDLINGS NON-DISMANTLABLE COMPLETE LINKAGE Definition and establishment mode; - Moulding; - Gluing; - Welding; - Riveting; - Socketing; - Crimping; DISMANTLABLE COMPLETE LINKAGE Definition and establishment mode by threaded connection; - By threaded devices (Tap screw, Nut, Bolt, Stud, Set screw) - By adjustable linkage (tangent plug, pinching, notched screw ...); - By non-threaded devices (pins, keys, splines) ELASTIC LINKAGE	- Good identification of various solutions of embedding linkages in a mechanism - Good Identification of complete connection devices in a mechanism - Representation and exact mounting of complete connection devices in a mechanism - standardized Designation of the connections devices	Starting from a real or virtual mechanism of the environment of the speciality, - Identify and give the standardized designation of the complete connection devices - Graphically represent a complete connection device mounted - Enumerate the realization rules of a welded joint as well as the main methods of welding
	Week N°26	- To define the concepts of functional dimension, dimension condition, and chain of dimensions; - To give a determination method of the chain of dimensions; - To indicate the rules of vectorial representation and calculation of dimensions in a chain of dimensions; - To set up a chain of dimensions	- Definitions ; Aim - Dimension condition ; dimension components - Functional surfaces - Chain of dimensions • Definition; proprieties • Plotting method: Dimensioning graph • Calculation of dimensions and clearance limits	- Good definition of the concepts of functional dimension, dimension condition, and chain of dimensions; - Good description of the determination method of the chain of dimensions; - Exact Determination of a dimensioning graph and exact plotting of a chain of dimensions on a drawing; - Exact Indication of the rules of vectorial representation and calculation of dimensions in a chain of dimensions;	Starting from an assembly drawing of real mechanism in its position use: - Define the concepts of functional requirements; - Identify the elements of a functional dimensioning; - Define and establish the dimensioning graph - Define and establish on an assembly drawing a chain of dimensions; - Calculate the dimensions and clearances relative to a chain of dimensions;
	27 28		REVISION		
	29	To apply acquired knowledge	EVALUATION		
	30		CORRECTION OF THE EVALUATION		