REPUBLIQUE DU CAMEROUN
Paix – Travail – Patrie
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MINISTERE DES ENSEIGNEMENTS SECONDAIRES
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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
****

REGONAL INSPECTORATE OF PEDAGOGY IN CHARGE OF INDUSTRIAL TECHNIQUES
****

MECHANICAL DESIGN
****

TEACHING SYLLABUS FOR APPLIED MECHANICS

☞ *LOWER SIXTH & UPPER SIXTH (ATVE)*

(AM/LV-EPS/F3-ELNI/F2-SMWIP/)

NOVEMBER 2020

TEACHING SYLLABUS FOR APPLIED MECHANICS - ATVE

STATEMENT OF THE COMPETENCE: TO ANALYSE THE BEHAVIOUR AND THE FUNCTIONING OF MACHINE ELEMENTS
MODULE TITLE: APPLIED MECHANICS
***CLASS :* LOWER SIXTH**
WEEKLY HOUR: 3Hrs (2Hours Theory + 1Hour Practicals)
Total theoretical lessons: 68 Hours thus: 44 hours + 12 hours for evaluation + 12 hours for integration activities
Total practical lessons: 34 Hours thus: 22 hours + 6 hours for evaluation + 6 hours for integration activities
MODULE DURATION: *102 hours*

COMPETENCE ELEMENTS	*CONTENTS / LESSONS*	*EVALUATION INDICATORS*	*TIME VOLUME*	*RECOMMANDATIONS From real or virtual mechanisms of the environment of the trade/specialty,*
A- STATICS (All trades)				
Identify and represent the common mechanical actions,	***NOTION OF VECTOR*** - *Recall on trigonometry* - *1st and 2nd degree equations* - *Vector definition : characteristics* - *Representation of a vector* - *Rectangular components of a vector* - *Vector operations (analytical and graphical): Sum; Multiplication of a vector by a scalar; Scalar or dot product.*	*Exactitude in:* - *Vector definition* - *Decomposition of a vector* - *Sum and vector products*	***04 hours***	***PRACTICALS : 2 Hours*** - *Plotting and vector operations* - *Vector composition and decomposition;*
	FORCE SYSTEMS: - *Definition and characteristics* - *Classification of forces (Contact forces, body forces)* ***TWO DIMENSIONAL FORCE SYSTEMS*** - *Rectangular components* - *Moment of a force* ▪ *About a point* ▪ *About an axis* - *Couples* - *Resultants* ***THREE DIMENSIONAL FORCE SYSTEMS*** - *Rectangular components* - *Moment and couple* - *Resultants*	*Exactitude in :* - *Decomposition of a force* - *Determination of moments of a force* - *Determination of rectangular components of a force* - *Determination of couples and moments of a mechanical action*	***04 hours***	***PRACTICALS : 2Hours*** - *Physical effect of forces and moments/couples* - *Determination of moment of a force about a point and about an axis ;*

	- *Newton's laws*			
	SOLIDS AND MATERIAL SYSTEM *Solid:* *- Mass and centre of gravity* *Material system* *- Internal forces & external forces* *- Principal of mutual action*	*Exactitude in:* *- Determination of mass and centre of gravity* *- Classification and inscription of mechanical actions*	***02 hours***	***PRACTCALS: 1 Hour*** *- Solids and material systems discovery;* *- Rigid bodies and material systems modelling* *- Characteristics of a rigid body: mass, volume…* *- Centre of gravity of a rigid body or material system*

COMPETENCE ELEMENTS	*CONTENTS / LESSONS*	*EVALUATION INDICATORS*	*TIME VOLUME*	*RECOMMANDATIONS From real or virtual mechanisms of the environment of the trade/specialty,*
Apply the Fundamental Principle of Statics to the equilibrium of rigid bodies subjected to 2, 3 and 4 forces	***EQUILIBRIUM OFA RIGID BODY: ANALYTICAL RESOLUTION*** - *System isolation (modelling the action of forces)* - *The free body diagram (Construction of the free body diagram)* - *Fundamental Principle of Statics* - *Categories of equilibrium in 2D* - *Two and three forces members* - *Equilibrium in 3D*	- *Good classification of mechanical actions* - *Good construction of the free body diagram* - *Good identification and representation of the components of the mechanical actions of connection and contact;*	***06 hours***	***PRACTCALS: 3Hours*** - *Discovery of mechanical actions;* - *Isolation of a solid or material system;* - *Construction of the free body diagram* - *State the principle of mutual actions.* - *Classify mechanical actions* - *Discovery of the principle of mutual actions.*
	EQUILIBRIUM OF SOLID: GRAPHIC RESOLUTIOI - *Graphic translation of the Fundamental Principle of Statics;* - *Definition, representation and interpretation of the Force polygon and equilibrium polygon* - *Applications to coplanar force systems: 2 coplanar forces;3 coplanar forces; 4 coplanar forces (Cullman's method*	- *Good rigid body isolation;* - *Exact inventory of mechanical action applied to a rigid body;* - *Good graphic interpretation of the Fundamental Principle of Statics for two and three forces members ;* - *Good graphic resolution;* - *Correct plotting of the force polygon;* - *Correct plotting of the equilibrium polygon*	***06 hours***	***PRACTICALS : 3Hours*** - *Graphic interpretation of the Fundamental Principle of Statics for cases of 3 and 4 force members;* - *Plotting of the force polygon and equilibrium polygon* - *Closing of the polygon* - *Application of Cullman's method*
	STRUCTURES **(Only for SMWIP)** - *Introduction* - *plane trusses* - *Method of joints* - *Method of sections* - *Frames and machines*	- *Good plotting of the separate free body diagrams of individual members of combination of members;* - *Good application of the force and moment equations of equilibrium ;* - *Good determination of the internal forces to a structure;*	***06 hours***	***PRACTCALS:3Hours*** - *Analysis of statically determinate structure* - *Application of the method of sections* - *Application of the method of joints* - *Sample problems on frames and machines*

	EQUILIBRIUM OF SOLID BODIES SUBJECTED TO FRICTION - *Types of friction : Dry / Fluid friction* - *Mechanism of dry friction* - *Mechanism of fluid friction* - *Static friction - Kinetic friction – friction angle* - *Notion of cone of static friction*	- *Good identification and representation of components of mechanical actions;* - *Good graphic writing/ interpretation of the Fundamental Principle of Statics ;* - *Good graphic resolution;* - *Correct plotting of the force polygon;*	***03 hours***	***PRACTCALS:2 Hours*** - *Graphic interpretation of the Dry / Fluid friction;* - *Application of the Fundamental Principle of Statics to solid bodies subjected to friction and writing the equilibriums equations;* - *Plotting/Interpretation of the force polygon and equilibrium polygon*

COMPETENCE ELEMENTS	*CONTENTS / LESSONS*	*EVALUATION INDICATORS*	*TIME VOLUME*	*RECOMMANDATIONS From real or virtual mechanisms of the environment of the trade/specialty,*
B- KINEMATICS (All trades)				
Determine the kinematic characteristics of rigid bodies in motion with respect to a given reference;	***KINEMATICS OF PARTICLE*** - *Introduction* - *Trajectory* - *Kinematic vectors:* - *Velocity vector* - *Acceleration vector* - *Representation of kinetic vectors* - Tangential and normal components of kinetic vectors - Different types of motions	- *Correct determination of the characteristics of the movement* - *Define the concepts of absolute and relative movement* - *Identify the main movements of rigid bodies* - *Indicate the trajectories of the points of rigid bodies* - *Define the main kinematic quantities* - *Define the movements of rigid bodies.* - *Indicate the properties of rectilinear motion of rigid bodies* - *Define velocities and accelerations* - *Represent and interpret graphs of velocities and accelerations* - *Define the characteristics of the rotation movement of rigid body* - *Write the equations of motion* - *Apply the notions of equiprojectivity and instantaneous center of rotation,* - *Determine the velocity vectors by the equiprojectivity method* - *Determine the velocity vectors by the CIR method,* - *Write the law of speed composition.*	***04 hours***	***PRACTICALS : 4Hours*** - *Discovery of the movement of a particle* - *Kinematic characteristics: abscissa, trajectory, velocity and acceleration;* - *Discovery of the notion of reference and motion of a rigid body (absolute motion and relative motion);*
	STUDY OF PARTICULAR MOTIONS Motion with rectilinear trajectory – General consideration – URM – UVRM Motion with a circular trajectory – General equations – UCM – UVCM		***04 hours***	
	TRANSLATION AND ROTATION MOTIONS OF A RIGID BODY Notion of rigid body - Translation motion of a rigid body - Rotation motion about a fixed axis		***06 hours***	***PRACTICALS : 3Hours*** - *Discovery / Simulation the translation movement of a rigid body* - *Main characteristic of translation motion: Abscissa, trajectory, velocity and acceleration of the points belonging to a rigid body in translation.*

	***GENERAL PLANE MOTION* (For all except SMWIP)** - *Definition of plane motion of solid* - *Velocity vector fields* - *Equiprojectivity of velocity vectors* - *Instantaneous Centre of Rotation;* - *Composition of motions and velocities;* - *Composition of the acceleration vectors*		***06 hours***	***PRACTICALS : 3Hours*** - *Discovery / Simulation: Rotation movement of a rigid body;* - *Main kinematic parameters of a rigid body in rotation movement: abscissa, trajectory, velocity and acceleration of the points belonging to a rigid body in rotation.*
			06 hours	***PRACTICALS : 3Hours*** - *Discovery/Simulation of general plane motion of rigid bodies;* - *Composition of movements; Velocity field;* - *Composition of velocity Vectors and accelerations;* - *Construction of the Instantaneous Centre of Rotation;*

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MODULE DURATION:*102 hours*

COMPETENCE ELEMENTS	*CONTENTS / LESSONS*	*EVALUATION INDICATORS*	*TIME VOLUME*	*RECOMMANDATIONS From real or virtual mechanisms of the environment of the trade/specialty,*
C- STRENGTH OF MATERIAL (Only Mechanical Engineering)				
Sizing of mechanical parts subjected to tensile, compressive or shear stresses	***GENERALITIES IN STRENGTH OF MATERIAL*** *- Purpose of strength of material* *- Support and types of beam* *- Properties of a plane area:* ▪ *First moment of area;* ▪ *Area moment of Inertia or second moment of area* *- Polar moment of inertia of a surface*	*- Good calculation of the moment of mass and the second moment of area of a cross-section;* *- Good definition of the concept of beam.* *- Good definition of the internal cohesive efforts and stresses;* *- Good definition and application of the hypotheses of Strength of Material* *- Good determination of external and internal cohesive efforts for simple stress* *- Good determination of stresses in a cross-section of a beam* *- Good determination of deformations* *- Good representation of internal cohesive efforts diagrams* *- Good application of the formulas of non failure and rigidity to size the elements* *- Good identification of the types of stresses*	***04 hours***	***PRACTICALS : 4Hours*** *- Beams discovery;* *- Simulation of an imaginary cut of beam and the behaviour of each part* *- Analysis and equilibrium of each beam part: Internal cohesive efforts;* *- Stress calculation.* *- Plotting and interpretation graph tests* *- Sizing elements subjected to tension , compression and shearing*
	STRESSES IN A BEAM *- Hypotheses in strength of material* *- External and Internal forces ;* *- Simple stresses in a beam: Normal, shear, bearing, torsional and bending stresses.*		***04 hours***	
	AXALY LOADED MEMBERS *- Stress and strain ;* *- Tensile test* *- Relation between stress and strain: Hooke's law and Young' modulus of elasticity,* *- Poisson's ratio: lateral strain* *- Concentration of stress* *- Tensile/compressive strength condition;*		***06 hours***	***PRACTICALS: 3Hours*** *- Tests /Simulation ; tensile – compression stress;* *- Diagrams of cohesive efforts;* *- Normal stress;* *- HOOKE's law: Strength condition and rigidity;*

	SHEARING - *Shear stress* - *Shear deflection* - *Relation between shear stress and shear strain* - *Shear strength condition* - *Modulus of rigidity*		***04 hours***	***PRACTICALS : 2Hours*** - *Tests /Simulation ; shear stress;* - *Diagrams of cohesive efforts;* - *Tangential stress;* - *HOOKE's law: Strength condition and rigidity;*

COMPETENCE ELEMENTS	*CONTENTS / LESSONS*	*EVALUATION INDICATORS*	*TIME VOLUME*	*RECOMMANDATIONS From real or virtual mechanisms of the environment of the trade/specialty,*
Sizing of mechanical parts subjected to tensile, compressive or shear stresses	***TORSION*** - *Definition* - *Unit angle of twist* - *Stress distribution in the cross section;* - *Twisting (torsional) moment (torque, torsional shear stress):* - *Relation between:* ▪ *Twisting moment and unit angle of twist* ▪ *Twisting moment and shear stress (rigidity)* - *Stress concentration* - *Torsion strength condition.*	- *Good determination of the external and internal cohesive efforts and stress analysis* - *Good representation of the diagrams of internal cohesive efforts and stresses*	***06 hours***	***PRACTICALS : 3Hours*** - *Test/simulation of a torsion stress ;* - *Internal cohesive efforts and Deformation limitations ;* - *Normal and shear stress;* - *Law of HOOKE : Strength Condition and rigidity ;*
	- *Definition - Representation of a loaded beam* - *Equations of the shearing effort and bending moment along the beam* - *Bending moment and shearing forces diagrams* - *Maximum bending moment* - *Point, uniformly, and combined loadings.* - *Determination of the maximum bending moment* - *Direct (axial) stress in beams* - *Shear stress in beams* - *Stress concentration* - *Representation of stress distribution in the cross section of a beam.* - *Bending strength condition.* - *Deflection of a beam.*	- *Good calculation of the moment of mass and the second moment of area of a cross-section; Good definition and application of the hypotheses of strength of material* - *Good determination of external and internal cohesive efforts* - *Good determination of stresses in a cross section of beam* - *Good representation of the diagrams of the internal cohesive efforts and stresses:* - *Correct sizing of a beam.*	***06 hours***	***PRACTICALS : 3Hours*** - *Test/simulation of a cross-bending stress ;* - *Internal cohesive efforts and deformation limitations ;* - *Normal and shear stress;* - *Law of HOOKE :* - *Bending strength Condition and rigidity*

COMPETENCE ELEMENTS	*CONTENTS / LESSONS*	*EVALUATION INDICATORS*	*TIME VOLUME*	*RECOMMANDATIONS From real or virtual mechanisms of the environment of the trade/specialty,*
Sizing of mechanical parts subjected to combined stresses	***COMBINED STRESSES*** - *Definition :* - *External mechanical actions* - *Internal cohesive mechanical action*	- *Good calculation of the moment of mass and the second moment of area of a cross-section; Good definition and application of the hypotheses of strength of material* - *Good determination of external and internal cohesive efforts* - *Good determination of stresses in a cross section of beam* - *Good representation of the diagrams of the internal cohesive efforts and stresses:* - *Correct dimensioning of a beam.*	***6 hours***	***PRACTICAL WORK: 3Hours*** - *Test/simulation of traction (compression) and bending combined stresses in a beam;* - *Internal cohesive efforts, moment sand deformation ;* - *Equivalent efforts and moments* - *Equivalent normal and shear stresses;*
	BENDING +TENSION / COMPRESSION - *Bending moment and equivalent stress* - *Strength condition* - *Stress diagrams*		***6 hours***	***PRACTICALS : 3Hrs*** - *Test/simulation of Bending and Twist combined stresses in a beam;* - *Internal cohesive efforts, moments and deformation ;* - *Equivalent efforts and moments* - *Equivalent normal and shear stresses;*
	BENDING + TORSION - *Bending moment and normal equivalent stress* - *Strength condition and rigidity ;*		***4 hours***	***PRACTICALS: 2Hrs*** - *Test/simulation of a combined stress of cross-bending + torsion ;* - *Internal cohesive efforts ;* - *Equivalent efforts and moments* - *Equivalent normal and shear stresses;* - *Law of HOOKE : Strength Condition and rigidity*

COMPETENCE ELEMENTS	*CONTENTS / LESSONS*	*EVALUATION INDICATORS*	*TIME VOLUME*	*RECOMMANDATIONS From real or virtual mechanisms of the environment of the trade/specialty,*
D- DYNAMICS (All trades)				
Apply the fundamental law of dynamics in Galilean reference to determine the kinematics and dynamic parameters of a rigid body in rectilinear motion or rotation about a fixed axis compared with a given reference.	***DYNAMICS OF A RIGID BODY IN TRANSLATION*** - *Newton's laws of motion* - *Inertia and mass of rigid body in translation;* - *Linear momentum of a rigid body in translation;* - *Fundamental Principle of Dynamics in translatio*	- *Good calculation of the moments of inertia of rigid bodies, linear and angular momentums* - *Good application of the Fundamental Principle of Dynamics to a rigid body in rectilinear and rotation motions*	***4 hours***	***PRACTICALS : 4Hrs*** – *Simulation of the relation force /couple and movement :* – *Linear momentum/ Angular momentum* - *Relation force-acceleration ;* - *Simulation of a rigid body in rectilinear motion or rotation motion about an axis,* - *Simulation of the relation forces /couple and velocity/acceleration:* - *Determination of the energetic parameters of a rigid body in rectilinear motion or rotation motion about an axis,* - *Graphs*
	DYNAMICS OF THE RIGID BODY IN ROTATION - *Inertia and mass of a rigid body in rotation;* - *Angular momentum of a rotating body;* - *Moment of inertia of a rigid body about an axis (Huygens's theorem)* - *Fundamental Principle of Dynamics in rotation*		***4 hours***	
Apply the concepts of Energy, Work and Mechanical Power	*WORK DONE BY A MECHANICAL ACTION* - *Work done by a force in translation* - *Work done by force in rotation or couple* *POWER OF A MECHANICAL ACTION* - *Power in translation* - *Power in rotation*	- *Good definition of work, power and energy (potential, kinetic and mechanic)* - *Good determination of the work and the mechanical power of a force / couple in a rectilinear or rotational movement* - *Good determination of the efficiency of a mechanism* - *Good calculation of the energy of a rigid body in rotation or in rectilinear translations* - *Good application of the principle of conservation of mechanical energy*	***04 hours***	***PRACTICALS : 4Hrs*** - *Simulation of a rigid body in rectilinear motion or rotation motion about an axis,* - *Simulation of the relation forces /couple and velocity/acceleration:* - *Determination of the energetic parameters of a rigid body in rectilinear motion or rotation motion about an axis,*
	ENERGIES - *Potential Energy : Definition, Variation* - *Kinetic energy of a rigid body in translation, /in rotation : Definition, Variation* - *Mechanical Energy of a rigid body in translation, /in rotation: Definition, Variation, Conservation.*		***04 hours***	