



**SCHOOL OF  
SCIENCE AND  
TECHNOLOGY**  
PAN-ATLANTIC UNIVERSITY

# Programme Manual

**B.Eng. Mechanical Engineering**



## 1.0. Mission

The School of Science and Technology (SST) is a community of people committed to creating and transmitting knowledge and competencies in science, engineering and technology by “*forming competent and socially responsible science and engineering professionals who are committed to the promotion of the common good of society and the advancement of the scientific and engineering profession*”.

## 2.0 Hands-on training: Student-centred with strong ties to industry

In order to achieve the above mission, the School seeks to:

- *Provide hands-on, practice-based, student-centred and industry-relevant programs that address technical expertise, industrial management and ethical responsibility.*
- *Develop partnerships and engage with relevant stakeholders through applied research that provides solutions to industry and societal problems and enhance engineering pedagogy.*
- *Provide entrepreneurship education along with science and engineering education.*
- *Make intellectual contributions which:*
  - a) *Support the practice of science, engineering and technology;*
  - b) *Contribute to the advancement of the science, engineering and technology disciplines; and*
  - c) *Create high quality teaching materials.*
- *Produce graduates who will lead efforts to achieve ever greater scientific, engineering and technology development with high ethical standards.*

To ensure industry relevance of engineering programmes our pedagogy will be in line with the world-class global best practices having engineering education delivery process that are student-centred with strong ties to industry driven by our programme educational objectives.

### 2.1 Programme Educational Objectives:

The SST programme educational objectives will be periodically reviewed with the full involvement of all key stakeholders including faculty members, students, advisory board members, alumni, and employers of graduates. Presently, the career and professional accomplishments that our programmes are preparing graduates to attain within a 3-5 years of graduation are:

<b>Start-ups &amp; innovative Entrepreneurs</b>	Graduates will become principals in the industries associated with engineering and professional engineers starting-up and growing their own new firms. They will become recognised experts working in government, consulting firms, and international organisations around the country and around the world addressing some of the most challenging problems of our times. With reputation as a source of
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	innovative solutions to complex problems, technology leaders in start-up tech companies based on societal demands, national needs, and competitive international markets.
<b>Researchers</b>	Graduates will become leading researchers and who create and disseminate new knowledge in engineering. They will complete masters and PhD programs of respected universities by conducting original research in related disciplines or in interdisciplinary topics, contribute to scientific community with novel research activities, and continue their field in permanent academic positions work in engineering, research and development, production, operations and management departments of Nigerian, African or international companies as engineers who can solve technical problems, take initiative, develop and execute projects, collaborate with others in a team and take the responsibilities of a leader.
<b>Lifelong Learning</b>	Graduates will pursue lifelong learning in generating innovative engineering solutions using research and complex problem-solving skills.
<b>Ethical Professional Engineer</b>	Graduates will demonstrate technical competency and leadership to be working as engineering professionals (registered engineers), acting ethically, adhering to standards, and be committed to the welfare of employees and the general population.

## 2.2 Student Outcomes:

At graduation, our students are expected to know and able to do the following:

<b>Engineering knowledge</b>	Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of developmental and complex engineering problems.
<b>Problem Analysis</b>	Identify, formulate, research literature, and analyse developmental and complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
<b>Design and development of solutions</b>	Proffer solutions for developmental or complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
<b>Investigation</b>	Conduct investigation into developmental or complex problems using research-based knowledge and research methods including design of

	experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions.
<b>Modern Tool Usage</b>	Create, select, and apply appropriate techniques, resources and modern engineering and ICT tools, including prediction, modelling and optimization to developmental and complex engineering activities, with an understanding of the limitations.
<b>The Engineer and Society</b>	Apply reasoning informed by contextual knowledge including Humanities and Social Sciences to assess societal, health, safety, legal and cultural issues, and the consequent responsibilities relevant to professional engineering practice.
<b>Environment &amp; Sustainability</b>	Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development.
<b>Ethics</b>	Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice, including adherence to the COREN Engineers Code of Conducts.
<b>Individual and Teamwork</b>	Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.
<b>Communication</b>	Communicate effectively on developmental or complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
<b>Project Management and Finance</b>	Demonstrate knowledge and understanding of engineering, management and financial principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.
<b>Lifelong learning</b>	Recognize the need for and have the preparations and ability to engage in independent and lifelong learning in the broadest context of technological and social changes.

### 2.3 Mapping of Student Outcomes to Programme Educational Objectives

Student Outcomes	Start-ups & innovative Entrepreneurs	Researchers	Lifelong Learning	Ethical Professional Engineer
Engineering knowledge				
Problem Analysis				
Design /development of solutions				
Investigation				
Modern Tool Usage				
The Engineer and Society				
Environment & Sustainability				
Ethics				
Individual and Teamwork				
Communication				
Project Management and Finance				
Lifelong learning				

### 3.0 Basic Principles

The following are the basic principles which will inform the teaching imparted in the B.Eng. programmes of the School of Science and Technology:

- Human beings are moral beings whose behaviours are not mechanically determined by either internal or external factors and who cannot attain fulfilment if they restrict their activity to the pursuit of their own individual interests.
- The purpose of an enterprise is not restricted to producing profits for their owners nor can the objective of maximising profit be the supreme standard of decision. Organisations are members of larger societies and must contribute to their common good. The activities of organisations must also be compatible with - and contribute to - the full human development of those who work in them.
- Organisations are not mere production units. First and foremost they must be human communities where all have an opportunity to participate and contribute responsibly to the common good of the organisation and that of society.
- Organisations are not justified in creating and marketing products or services by the mere fact that a demand for them exists or can be created. The value of the organisation's activity ultimately depends on its serving authentic human needs and values.
- Organisations must respect the dignity of all the human persons (employees, customers, suppliers...) with whom they relate in the exercise of their activity. A person's dignity is not respected when one chooses to harm him or her, even if this is done as a means to attain some desirable objective.

## 4.0 Philosophy

The general philosophy of the Mechanical Engineering programme is to produce graduates with high academic standard and adequate practical background for self-employment as well as being of immediate value to industry and the community in general.

The Degree programme in Mechanical Engineering of the Pan-Atlantic University is intended to provide a solid foundation in the principles and practices of engineering for young people who look forward to a career in engineering. It is also a preparation for those young people interested in an academic career and entrepreneurship in the area of engineering.

Emphasis will be given to the knowledge of problem solving approaches, critical thinking about, and in-depth analysis of, engineering issues and problems, and the acquisition of a capacity for ethical and competent professional performance.

Furthermore, the programme is informed by the aspiration to train mechanical engineering professionals in the areas of design, manufacturing, mechatronics/robotics, materials, fluid mechanics, thermodynamics, fabrication of machinery and machine elements, electromechanical devices, use of computer aided engineering tools, etc., and who would uphold the highest intellectual, ethical and professional values that promote creativity, social responsibility, and the spirit of enterprise.

***The programme will prepare students for careers in the vast areas where mechanical engineering is applied such as in aviation/aerospace, power plants, biotechnology, shipbuilding, oil and gas rigs and platforms, vehicle design & assembly, railway, military hardware, industrial robotics/automation, general maintenance, consumer product manufacturing, healthcare, mechanized agriculture, HVAC and construction industries, among others. In reality, mechanical engineers can work anywhere given the versatility of the field. With the skills students will acquire in this programme, they will be better equipped to contribute to improving national productivity and economic growth in general while earning a decent living.***

## 5.0 Objectives

The fundamental aim of the Mechanical Engineering programme is tied to that of the University through the School of Science and Technology. It is *to form competent and socially responsible engineering professionals who are committed to the promotion of the common good of society and the advancement of the engineering profession.* The programme further aims to produce engineering manpower with the adequate knowledge and skills to handle engineering situations/problems competently and ethically. To achieve this, the programme will prepare the graduates:

- (i) To design engineering projects and supervise their implementation.

- (ii) To design and make components, machines, equipment and systems.
- (iii) To design and develop new products and production techniques in industries.
- (iv) To install and maintain complex engineering systems so that they can perform optimally in our environment.
- (v) To adapt and adopt exogenous technology in order to solve local engineering problems.
- (vi) To be able to exercise original thought, have good professional judgment and be able to take responsibility for the direction of important tasks.
- (vii) To develop appropriate leadership, interpersonal, organizational and entrepreneurial skills.
- (viii) To improve on indigenous technology to enhance local problems solving capability
- (ix) To be conversant with all the materials, components, machines, equipment, production techniques and systems in Mechanical Engineering.
- (x) To man and maintain the specific production equipment in Mechanical Engineering.
- (xi) To plan, manage and be responsible for quality control of the products and processes in the plant/factory.
- (xii) To be able to manage people, funds, materials and equipment.

Other specific objectives of the programme are:

- Provide a high quality Bachelor's degree programme in the area of Mechanical Engineering comparable to the best in the world.
- To prepare high calibre of mechanical engineering graduates who are well equipped with requisite knowledge, skills, competencies and practices of mechanical engineering in order to serve the needs of local and international industries in the private and public sectors.
- To involve the students in an intellectually stimulating and satisfying experience of engaged learning through continuous professional development activities that adapts to changes in the work environment.
- To prepare the students to play key roles in the professional engineering bodies.
- To provide students with knowledge and skills base for further studies in mechanical engineering or multi-disciplinary studies in science and technology.

## **6.0 Admission and Matriculation Requirements**

Prospective students would need to satisfy the following general requirements:

- (a) Admissions shall be through the Joint Admissions and Matriculations Board (JAMB);
- (b) For admission to 100-Level through the Unified Tertiary Matriculation Examination (UTME), candidates should:



- i. Obtain at least five (5) credit passes at Senior Secondary School Certificate Examination (SSSCE) or equivalent in relevant subjects including English Language, Mathematics, Physics and Chemistry in not more than two sittings;
  - ii. Score preferably a minimum of 220 points in UTME. The minimum point required is subject to review by the University from time to time.
  - iii. Pass the Post-UTME interview organized by the university.
  - iv. It is also desirable for candidates to pass Further Mathematics and Technical Drawing at credit level, as such candidates shall have added advantage.
- (c) For admission into 200-Level (Direct Entry), candidates should (in addition to 5 SSCE credits in relevant subjects including English Language and Mathematics in not more than two sittings):  
Pass Mathematics, Physics and Chemistry at GCE 'A' level or equivalent. Holders of National Diploma at minimum of Upper Credit level are eligible for consideration for admission into 200 level. They are also required to pass the interview organized by the university.
- (d) *Inter-University Transfer Mode*  
Students can transfer into 200-Level courses provided they have the relevant qualifications and pass the interview organized by the Pan-Atlantic University (PAU). PAU is to satisfy itself that the grades obtained by such candidates from their previous institution are acceptable.

## **7.0 The Semester Course System**

The undergraduate programmes will run on the Semester Course basis. There shall ordinarily be two semesters in an academic year, except the University Council through Senate shall provide otherwise.

- (i) Instruction in the programme shall be by courses.
- (ii) There shall be five levels of courses in line with the years of study. Level or year 1 courses are 100, 101 etc. and Level 2 or year 2 courses are 200, 201 etc.
- (iii) Students will be required to complete their registration for the courses within the period stipulated by the School. Amendment of this registration will be allowed through the addition or deletion of courses but it must take place within three weeks of the commencement of lectures.

## 8.0 Examination and Grading System

Students will be evaluated through a combination of Laboratory Experiments, Continuous Assessment Tests (30%), Class participation (5%), End-of-Semester Examinations (65%). For the purely practical/workshop courses, Continuous Assessment will carry 100 marks.

To be eligible to sit for any examinations, students will be expected to attend a minimum of 80% of the lectures of any course registered for. The School reserves the right to prevent any defaulting student from sitting for the relevant examination.

All courses registered for will be taken into consideration during the computation of results. Students will not be credited for courses which they did not register for, even if they are inadvertently allowed to take the examinations and pass them. Failure to take the examination in a course for which one has registered will attract a score of 0.0, which will have the consequent effect of lowering the student's Grade Point Average.

- (i) Special examinations to enable a student graduate may in exceptional circumstances be held by order of Senate.
- (ii) Grades will be awarded based on the scores of the students as follows:

Percent score	Grade point	Letter Grade
70 – 100	5.0	A
60 – 69.9	4.0	B
50 – 59.9	3.0	C
45 – 49.9	2.0	D
0 – 44.9	0.0	F

For the purpose of description, a score below 2 Grade Points constitutes a failure.

The following qualifications shall be applied to the grades:

<b>A</b>	Very Good
<b>B</b>	Good
<b>C</b>	Fair
<b>D</b>	Pass
<b>F</b>	Poor Performance

- (iii) To obtain the Cumulative Grade Point Average (CGPA) of the student, the grade point assigned to the mark obtained in each course is multiplied by the units of that course. The total from all the courses is added up to give the total weighted grade point. This total is then divided by the total number of units taken by the student to give the grade point average.
- (iv) For the purpose of calculating a student's CGPA, grades obtained in ALL registered courses, whether passed or failed, must be included in the computation.

## **9.0 Retention and Progression**

To remain in the School, students will be required to ensure that their CGPA does not fall below a certain minimum standard. A student must pass all the specified courses, and obtain a minimum CGPA of 1.5 at the end of every semester. Any student who does not meet this requirement will be placed on probation. If after one semester on probation the CGPA remains below 1.5, the student shall be asked to withdraw. A student on probation should register for a maximum of 18 credit units.

### **10.0 Period of Study and Requirements for the Award of a Degree**

The normal period of study for a degree shall be ten (10) semesters. The minimum number of course units for the award of a degree shall be 220.

The determination of the class of degree shall be based on the weighted grade points of all the courses taken. The award of the degree shall be dependent on the student having obtained a Cumulative Grade Point Average of at least 1.5 in addition to fulfilling other minimum requirements for an honours degree.

The following classes of degree are approved for the CGPA indicated:

<b>Class of Degree</b>	<b>Cumulative GPA</b>
<b>First Class</b>	<b>4.50 - 5.00</b>
<b>Second Class (<i>Upper Division</i>)</b>	<b>3.50 - 4.49</b>
<b>Second Class (<i>Lower Division</i>)</b>	<b>2.40 - 3.49</b>
<b>Third Class</b>	<b>1.50 - 2.39</b>
<b>Fail</b>	<b>Less than 1.5</b>

The maximum number of semesters for the award of an honours degree shall be fourteen semesters.

### **11.0 Graduation Requirements**

To qualify for the award of a degree of Pan-Atlantic University, a student is required to have:

- (i) Completed and passed the prescribed number of units including all compulsory courses of the programme as specified by the University.
- (ii) Completed and met the standards for all required and elective courses.
- (iii) Obtained the prescribed minimum CGPA.

<b>Level</b>	<b>Semester I</b>	<b>Semester II</b>	<b>TOTAL</b>	<b>SIWES/Project</b>
<b>100</b>	26	25	51	0
<b>200</b>	24	24	48	6
<b>300</b>	23	22	45	6
<b>400</b>	23	0	23	6
<b>500</b>	19	18	37	6
<b>TOTAL</b>	<b>115</b>	<b>89</b>	<b>204</b>	<b>24</b>

<b>Group</b>	<b>Percentage</b>
Basic Science	15.4%
CAD/CAM/CAE/Automation	17.9%
General Engineering	25.2%

General Studies/Soft Skills	9.4%
Industry/Research Experience	10.3%
Management	9.0%
Thermo-Fluids	12.8%

**12.0 CURRICULUM FOR B.Eng. DEGREE IN MECHANICAL ENGINEERING IN  
AGREEMENT WITH THE NUC MINIMUM STANDARDS (2018) & COREN OBE BMAS  
2019**

NOTE the following legend for the list of courses below:

C = Compulsory Course – A course which every student must compulsorily take and pass in any particular programme at a particular level of study.

E = Elective Course – A course that students take within or outside the faculty (school). Students may graduate without passing the course provided the minimum credit unit for the course had been attained.

R = Required Course – A course that you take at a level of study and must be passed before graduation

LH = Lecture Hours per semester

PH = Practical Hours per semester

### Course Structure at 100-Level Engineering Degree Programme

Course Code	Course Description Semester I	Units	Status	PRE	LH	PH
GET 111	Basic Engineering Drawing	2	C	-	15	45
CHM 101	General Chemistry I (Physical)	3	C	-	45	
CHM 107	General Practical Chemistry I	1	C	-		45
MTH 101	Elementary Mathematics I	3	C	-	45	
MTH 103	Elementary Mathematics II	3	C	-	45	
PHY 101	General Physics I	3	C	-	45	
PHY 106	General Physics III (Heat, Sound, Waves)	3	C	-	45	
PHY 107	General Practical Physics I	1	C	-		45
STA 101	Statistics for physical science and engineering	3	C	-	45	
GST 101	Communication in English I	2	C	-	30	
GST 103	Use of Library, Study Skills and Information Communication Technology	2	C	-	30	
	<b>TOTAL UNITS</b>	<b>26</b>				

Course Code	Course Description Semester II	Units	Status	PRE	LH	PH
CHM 102	General Chemistry II (Inorganic)	3	R	-	45	
CHM 106	General Chemistry III (Organic)	2	C	-	30	
CHM 108	General Practical Chemistry II	1	R	-		45
MTH 102	Elementary Mathematics III (Differential & Integral Calculus)	3	R	MTH 101	45	
MTH 104	Elementary Mathematics IV (Vectors, Geometry & Dynamics)	3	C	MTH 101	45	
PHY 102	General Physics II (Electricity, Magnetism & Modern Physics)	3	R	PHY 107	45	
PHY 108	General Physics Practical II	1	R	-		45
GST 102	Introduction to Christian Theology	3	C	-	45	
GST 104	Logic, Philosophy and Human Existence	2	R	-	30	
GST 105	Communication in English II	2	C	-	30	
GST 125	Contemporary Health Issues	2	R	-	30	
	<b>TOTAL UNITS</b>	<b>25</b>				

**Course Structure at 200-Level Engineering Degree Programme**

<b>Course Code</b>	<b>Course Description Semester I</b>	<b>Units</b>	<b>Status</b>	<b>PRE</b>	<b>LH</b>	<b>PH</b>
GET 201	Fundamentals of Electrical Engineering I	3	C	-	30	45
GET 203	Engineering Drawing I	2	C	-	15	45
GET 205	Workshop Practice	1	C	-		45
GET 207	Engineering Mechanics I	3	C	-	45	
GET 209	Engineering Mathematics I	3	R	-	45	
GET 211	Engineering Materials	3	R	-	45	
GET 213	Fundamentals of Thermodynamics	3	C	-	30	45
ENT 201	Entrepreneurship I	2	C	-	15	45
GST 202	Philosophical Anthropology	2	C	-	30	
GST 211	Environment and Sustainable Development	2	R	-	30	
	<b>TOTAL UNITS</b>	<b>24</b>				
<b>Course Code</b>	<b>Course Description Semester II</b>	<b>Units</b>	<b>Status</b>		<b>LH</b>	<b>PH</b>
GET 202	Fundamentals of Electrical Engineering II	3	C	GET 201	30	45
GET 206	Fundamentals of Fluid Mechanics I	3	C	-	30	45
GET 208	Strength of Materials	3	C	-	30	45
GET 210	Engineering Mathematics II	3	R	GET 209	45	
GET 212	Fundamentals of Computer Aided Engineering	3	R	-	30	45
GET 222	Engineering Drawing II	2	C	GET 203	15	45
GET 224	Engineering Communication	2	C	-	30	
ENT 202	Entrepreneurship II	2	C	ENT 201	15	45
GST 204	Peace studies, Conflict Resolution & Ethics	3	R	-	45	
	<b>TOTAL UNITS</b>	<b>24</b>				
GET 299	SIWES I (Project-based with Engineering Design)	6	C			12 weeks

**Course structure at 300-Level Mechanical Engineering**

<b>Course Code</b>	<b>Course Description Semester I</b>	<b>Units</b>	<b>Status</b>	<b>PRE</b>	<b>LH</b>	<b>PH</b>
<b>MEE 307</b>	Theory of Machines I	3	C		30	45
<b>MEE 309</b>	Thermodynamics -II	3	C	GET 213	30	45
<b>MEE313</b>	Engineering Technology	2	C		15	45
<b>MEE 315</b>	Control Systems	3	R		45	
<b>MEE 331</b>	Engineering Drawing III	3	C	GET 222	15	90
<b>EEE 301</b>	Electronic Circuits I (Analogue)	2	R		30	
<b>GET 301</b>	Engineering Mathematics III	3	R	GET 210	45	
<b>GET 303</b>	Engineer in Society & Professional Ethics	2	R		30	
<b>GST 303</b>	Nigerian Peoples and Culture	2	R		30	
	<b>TOTAL UNITS</b>	<b>23</b>				
<b>Course Code</b>	<b>Course Description Semester II</b>	<b>Units</b>	<b>Status</b>		<b>LH</b>	<b>PH</b>
<b>MEE 308</b>	Manufacturing Technology	2	R	MEE 312	15	45
<b>MEE 310</b>	Fluid Mechanics II	3	C	GET 206	30	45
<b>MEE 312</b>	Engineering Metallurgy	2	R		30	
<b>MEE 322</b>	Metrology	3	R		30	45
<b>MEE 324</b>	Mechanics of Materials - I	3	C		45	
<b>EEE 302</b>	Electronic Circuits II (Digital)	2	R		30	
<b>EEE 306</b>	Electrical Machines - I	2	R		30	
<b>MCT 302</b>	Introduction to Robotics	2	C		30	
<b>GET 302</b>	Engineering Mathematics IV (Numerical Methods)	3	R	GET 301	45	
	<b>TOTAL UNITS</b>	<b>22</b>				
<b>GET 399</b>	SIWES II (Project-based with Engineering Design)	6	C		12 weeks	

**Course structure at 400-Level Mechanical Engineering**

<b>Course Code</b>	<b>Course Description Semester I</b>	<b>Units</b>	<b>Status</b>	<b>PRE</b>	<b>LH</b>	<b>PH</b>
<b>MEE 403</b>	Applied Thermodynamics & Heat Transfer III	4	C	MEE 309	45	45
<b>MEE 405</b>	Fluid Mechanics III	3	C	MEE310	30	45
<b>MEE 407</b>	Theory of Machines II	3	C	MEE 307	30	45
<b>MEE 409</b>	Machine Design I	3	C		45	
<b>MEE 411</b>	Advanced Mechanics of Materials - II	3	R	MEE 321	45	
<b>MCT 411</b>	Introduction to Mechatronics Engineering	2	C		30	
<b>GET 401</b>	Cost Engineering	2	C		30	
<b>GET 403</b>	Engineering Economics	3	C		45	
	<b>TOTAL UNITS</b>	<b>23</b>				
<b>Course Code</b>	<b>Course Description Semester II</b>	<b>Units</b>	<b>Status</b>			
<b>GET 499</b>	SIWES III (Project-based with Engineering Design)	6	C		24 weeks	

**Course structure at 500-Level Mechanical Engineering**

Course Code	Course Description Semester I	Units	Status	PRE	LH	PH
<b>MEE 501</b>	Applied Thermodynamics IV	3	C	MEE 403	30	45
<b>MEE 503</b>	Heat Transfer V	3	C	MEE 403	30	45
<b>MEE 505</b>	Engineering Design Processes	2	C		30	
<b>MEE 511</b>	Tribology	2	C		30	
<b>GET 501</b>	Engineering Management	3	R		45	
	<b>ELECTIVES (Select 6 Units)</b>	<b>13</b>				
<b>MEE 507</b>	Theory of Elasticity	4	E		45	45
<b>MEE 509</b>	Fracture of Structural Materials	4	E		45	45
<b>MCT501</b>	Automation & Robotics	2	E		15	45
	<b>TOTAL UNITS</b>	<b>19</b>				
Course Code	Course Description Semester II	Units	Status		LH	PH
<b>MEE 502</b>	Fluid Dynamics	3	C	MEE 405	45	
<b>MEE 504</b>	Machine Design II	4	C	MEE 409	30	90
<b>MEE 512</b>	Turbomachinery	2	C	MEE 405	30	
<b>GET 502</b>	Engineering Law	3	R		45	
<b>GET 504</b>	Engineering Valuation/Appraisal	2	C		30	
<b>MEE599</b>	Student Capstone Project*	<b>6</b>	<b>C</b>			<b>270</b>
	<b>ELECTIVES (Select 4 Units)</b>	<b>20</b>				
<b>MCT 512</b>	Process Automation	2	E		<b>15</b>	45
<b>MEE 510</b>	Plasticity	2	E		30	
<b>TAE504</b>	Automotive System Design	2	E		30	
	<b>TOTAL UNITS</b>	<b>24</b>				

(\*) The Project load is divided between the first and the second semester.

The estimated load of the first semester is 1/3 of the total year load for the project.

## **DETAILED COURSE DESCRIPTION 100-LEVEL - SEMESTER I**

### **GET 111 Basic Engineering Drawing**

**(2 Units, LH15 PH 45)**

Introduction of Engineering Drawing as means of communication. Drawing paper format. Use of drawing instruments. Type of lines and their use in Engineering Drawing. Circles and tangents. Plane geometry. Circles to satisfied conditions involving other circles, lines and points. Conic sections, various methods of their construction. Cycloid, epicycloids, and hypocycloids, involute. Archimedes spiral. Helix (cylindrical and conical) single and multi-start threads. Coiling of compression and tension springs. Loci- Paths of points on moving link work. The theory of projection. Perspective (briefly), parallel projections (oblique – general, cavalier, cabinet). (Orthographic – Multi-view, two views, three views, auxiliary views). (Axonometric – Isometric, Diametric, Trimetric). Multiview representation. 1<sup>st</sup> and 3<sup>rd</sup> angle projections. Isometric drawings. Oblique drawings. Freehand sketching.

### **CHM 101 General Chemistry I (Physical)**

**(3 Units, LH 45)**

Atoms, molecules and chemical reactions (types and properties). Modern electronic theory of atoms: atomic Spectra – the Bohr atom and extension of Bohr theory. Electronic configuration, periodicity and building up of the periodic table. Hybridisation, molecular orbital theory, the LCAO method, homo- and heteronuclear diatomic molecule, and shape of simple covalent molecules. Valence forces; Structure of Solids. Chemical equations and stoichiometry (Balancing of equation by electron transfer method, mole concepts and calculations involving titrimetry). Chemical bonding and intermolecular forces (van der Waals, hydrogen bonding, dipole-dipole interaction). Kinetic theory of matter: Properties of gases - ideal and non-ideal behaviour. Elementary Thermochemistry; rates of reaction, equilibrium and thermodynamics. Acids, bases and salts. Redox reactions and introduction to electrochemistry. Radioactivity.

### **CHM 107 General Practical Chemistry I**

**(1 Unit, PH 45)**

Laboratory experiments designed to reflect the topics taught in CHM 101 such as qualitative and quantitative chemical analysis, acid-base titrations. Gravimetric analysis. Calculation, data analysis and presentation. Functional group analysis.

### **MTH 101 Elementary Mathematics I: (Algebra and Trigonometry)**

**(3 Units, LH 45)**

Indices and logarithms, Inequalities, and polynomials (including factor and remainder theorems), Theory of equations, Theory of quadratic, cubic and quartic equations, Binomial theorem, Partial fractions, Complex numbers, Circular measure, Trigonometric functions of angles of any magnitude, addition and factor formulae, expansion of  $\sin n\theta$ ,  $\cos n\theta$ ,  $\tan n\theta$ .

**MTH 103 Elementary Mathematics II:  
(Set Theory and Numbers)**

**(3 Units, LH 45)**

Elementary set theory, subsets, union, intersection, complements and Venn diagrams, Real numbers: integers, rational and irrational numbers, Surds, Mathematical induction, Real sequences and series, Complex numbers: algebra of complex numbers, the Argand Diagram, De-Moiré's theorem nth roots of unity.

**PHY 101 General Physics I  
(Mechanics & Properties of Matter)**

**(3 Units, LH 45)**

Space and Time, Units and dimension, Kinematics; Fundamental Laws of Mechanics, statics, and dynamics; work and energy; Conservation laws. Moments and energy of rotation; simple harmonic motion; motion of simple systems. Elasticity; Hooke's law, Young's shear and bulk moduli. Hydrostatics; Pressure; buoyance, Archimedes' principle; Surface tension: adhesion, cohesion, capillarity, drops and bubbles; Temperature; heat; gas laws; laws of thermodynamics; kinetic theory of gases; Sound: Types and properties of Waves as applied to sound and light energies; Superposition of waves. Propagation of sound in gases, solids and liquids and their properties.

**PHY 106 General Physics III:  
(Heat, Sound and Optics)**

**(3 Units, LH 45)**

Temperature, thermometers, heat transfer, PVT-surfaces, Kinetic theory, first and second laws of thermodynamic, transverse, and longitudinal waves, standing waves, intensity, beats. Doppler Effect, Electromagnetic spectrum. Huygen's principle, images formed by a single surface thin lenses, aberrations, the eye, optical instruments, interface, single slit, diffraction grating, polarization, Malus' law.

**PHY 107 General Practical Physics I**

**(1 Unit, PH 45)**

This introductory practical part of course emphasizes quantitative measurements, the treatment of measurement errors, and graphical analysis. A variety of experimental techniques will be employed. The experiments include studies of meters, the oscilloscope, mechanical systems, electrical and mechanical resonant systems, light, heat, viscosity, etc., covered in PHY 101 and PHY 102. However, emphasis should be placed on the basic physical techniques for observation, measurements, data collection, analysis and deduction. A selection of experiments such as: use of measuring instruments, viscosity, surface tension oscillations about an equilibrium position, Hooke's law, moment of inertia, focal lengths of lenses, refractive index, volume expansion and latent heat, etc.

**STA 101 Statistics for Physical Sciences and Engineering**

**(3 Units, LH 45)**

Descriptive statistics, frequency distribution, populations and sample, central tendency, variance data sampling, mean, median, mode, mean deviation, percentiles etc. Probability. Binomial, poisson hyper-geometric, normal distributions, etc. Statistical inference intervals, tests hypothesis and significance. Regression and correlation

### **GST 101 Communication in English I**

**(2 Units, LH 30)**

Effective communication and writing in English Language skills, essay writing skills (organization and logical presentation of ideas, grammar and style), comprehension, sentence construction, outlines and paragraphs. This course is an overview of grammatical structure. Attention will be paid to the parts of speech (nouns, pronouns, verbs, prepositions, adjectives, adverbs, conjunctions, and interjections) as well as markers of noun (articles, quantifiers predetermine, demonstratives) and modality in verb use. The course will also study phrases and clauses, sentence structure, the sentence in use, punctuation, capitalization and spelling. It will provide an introduction to paragraph structure, critical thinking in writing, speech planning and organization.

### **GST 103 Use of Library, Study Skills and ICT**

**(2 Units, LH 30)**

Brief history of libraries; Library and education; University libraries and other types of libraries; Study skills (reference services); reading and comprehension; listening and comprehension; note-taking and note-making; word processing. The use of dictionaries, encyclopaedia, and other reference materials; the library and learning; organization of the library system; finding information in a library; Types of library materials, using library resources including e-learning, e-materials, etc.; Understanding library catalogues (card, OPAC, etc.) and classification; Copyright and its implications; Database resources; Bibliographic citations and referencing. Development of modern ICT; Hardware technology; Software technology; Input devices; Storage devices; Output devices; Communication and internet services; Identification of PC parts and peripheral devices: functions, applications, and how to use them. Safety precautions. Procedure for booting a PC. Filing system: directory, sub-directory, file, path, and how to locate them. Word processing skills (typing, etc.), Spreadsheet, Database management, Presentation software. Exercises.

## **DETAILED COURSE DESCRIPTION 100-LEVEL - SEMESTER II**

### **CHM 102: General Chemistry II (*inorganic*)**

**(3 Units: LH 45)**

Solutions Chemistry: types of solutions, solubility, vapour pressure, solubility product and pH determination. Origin of quantum theory. Stereochemistry. Electrode potential and non-aqueous solvent. The chemistry of selected metals and non-metals: comparative Chemistry of groups IA, IIA, IVA elements. The chemistry of non-metallic elements: hydrogen and hydrides, main group elements of 2nd and 3rd periods and their compounds, oxygen and oxides, chalcogen and chalcogenides, halogens and halides, rare gases and their compounds. Introduction to transition metal chemistry. Coordination compounds (structure of complexes, coordination number and geometry), Nomenclature, Isomerism, Simple treatment of Crystal Field Theory, Splitting of D-orbitals into octahedral, square-planar, and tetrahedral. Inorganic Chemicals: Application in Chemistry, Agriculture, Medicine and Industry.

**CHM 106: General Chemistry III (*Organic*) (3 Units, LH 45)**

Historical survey of the development and importance of Organic Chemistry. Electron theory in organic chemistry; saturated hydrocarbons, unsaturated hydrocarbons. Isolation and Purification of organic compounds. Determination of structures of organic compounds including qualitative and quantitative analysis in organic chemistry. Nomenclature and functional groups classes of organic compounds. Introductory reaction mechanism and kinetics. Carbon hybridization, Homologous series, functional group chemistry. The Chemistry of alkanes, alkenes, alkynes, alcohols, ethers, amines, alkyl halides, nitriles, ketones, carboxylic acids and derivatives.

**CHM 108 General Practical Chemistry II: (1 Unit, PH 45)**

Continuation of CHM 107. Additional laboratory experiments to include functional group analysis, quantitative analysis using volumetric methods.

**MTH 102 Elementary Mathematics III: (3 Units, LH 45)**  
**(*Differential and Integral Calculus*)**

Functions of a real variable, graphs, limits and idea of continuity. The derivative as limit of rate of change. Techniques of differentiation, maxima and minima. Extreme curve sketching, integration, Definite integrals, reduction formulae, application to areas, volumes (including approximate integration: Trapezium and Simpson's rule).

**MTH 104 Elementary Mathematics IV: (3 Units, LH 45)**  
**(*Vectors, Geometry & Dynamics*)**

3-Dimensional Cartesian Coordinate Systems. Definition and Representation of Vectors, Algebra of Vectors, Multiplication of a Vector by a Scalar, Addition of Vectors, Scalar Products of two Vectors, Direction Cosines, Calculus of Vector Functions, Differentiation of Vector Function, Integration of Vector Function. Conic: Circles, Parabola, Ellipse and Hyperbola. Kinematics

**PHY 102 General Physics II: (3 Units, LH 45)**  
**(*Electricity, Magnetism and Modern Physics*)**

Electrostatics; conductors and currents; dielectrics; magnetic fields and electromagnetic induction, Maxwell's equations; electromagnetic oscillations and waves; Coulomb's laws; method of charging; Ohm's law and analysis of DC circuits; AC Voltages applied to Inductors, Capacitors, and resistances; Applications.

**PHY 108 General Practical Physics II: (1 Unit, PH 45)**

This is a continuation of the experiments designed for PHY 101 and PHY 102 some of which have been covered under PHY 107.

**GST 102 Introduction to Christian Theology (3 Units, LH 45)**

The Existence of God; Revelation; Supernatural Faith; God's Nature and Action; The Holy Trinity; Creation; Elevation to the Supernatural Order and original Sin; Jesus Christ, True God and True Man; The Incarnation ; The Passion and Death on the Cross; Resurrection,

Ascension and Second Coming; The Holy Spirit, the Holy Catholic Church; The Communion of Saints and the Forgiveness of Sin; History of the Church; The Church and the State; The Resurrection of the Body and Life Everlasting; Introduction to the Liturgy and the Sacraments; Baptism and Confirmation; The Eucharist; Penance; Anointing of the Sick; Holy Orders; Marriage; Freedom, Law and Conscience; Morality of Human Acts; Grace and the Virtues; The Person and Society; Personal Sin; The Ten Commandments; Prayer.

**GST 104 Logic, Philosophy and Human Existence (2 Units, LH 30)**

A brief survey of the main branches of Philosophy; Rudiments and dynamics of critical thinking as a major component of knowledge production. Such forms of knowledge as good and bad arguments, the capacity to think clearly and rationally, to engage in reflective and independent thinking and to reason logically, coherently and purposefully towards a particular end. Topics include: logic and logical reasoning: the nature of reasoning: deduction and induction; the structure of argumentation; forms of fallacies; types of discourse; techniques for evaluating arguments; symbolic logic; Special symbols in Symbolic logic-conjunction, negation, affirmation, disjunction, equivalent and conditional statements, law of tort. The method of deduction using rules of interference and bi-conditional, qualification theory. Types of discourse, nature or arguments, validity and soundness, techniques for evaluating arguments, distinction between inductive and deductive inferences; etc. (Illustrations will be taken from familiar texts, including literature materials, novels, law reports and newspaper publications.

**GST 105 Communication in English II (2 Units, LH 30)**

Communication in English II builds on the foundation laid by the first part of the course. It aims to strengthen the foundation and further understanding of the grammatical elements through increased writing and reading exercises. The course reviews the use of the parts of speech in writing as well as sentence construction, but it focuses in particular on difficult verbs, the gerund, voice, mood, agreement, high frequency spelling, punctuation, and the rules governing the use of capital letters. It will also provide guidelines on critical reading, summary writing, and speech writing while reviewing argument and paragraph structures. Logical presentation of papers; Phonetics; Instruction on lexis; Art of public speaking and oral communication; Figures of speech; Précis; Report writing.

**GST 125 Contemporary Health Issues (2 Units, LH 30)**

Diet, exercise and health, nutritional deficiency diseases, malaria, other infections, hypertension, organ failure, air-borne diseases, sexually transmitted diseases, cancer and its prevention, sickle cell disease. HIV/AIDS & COVID-19: Introduction, epidemiology, natural history of infection, transmission of predisposing factors, Impact on the society, management of infection, prevention. Drugs and Society: sources of drugs, classification of drugs, dosage forms and routes of drug administration, adverse drug reactions, drug abuse and misuse, rational drug use and irrational drug use. Human kinetics and health education: personal care and appearance, exercise and health, personality and relationship, health emotions, stress, mood modifiers, refusal to tobacco, alcohol and other psychoactive drugs.



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**PAN-ATLANTIC UNIVERSITY**

## **DETAILED COURSE DESCRIPTION 200-LEVEL - SEMESTER I**

### **GET 201 Fundamentals of Electrical Engineering I (3 Units, LH 30, PH45)**

Fundamental Concepts-Electric Fields, charges, magnetic fields. Current, B-H curves. Kirchhoff's laws, superposition. Thevenin's and Norton's Theorems, Reciprocity, RL, RC, RLC circuits. DC, AC bridges, Resistance, Capacitance, Inductance measurements, Transducers, Single phase circuits. Complex J- notion, AC circuits, Impedance, Admittance, susceptance.

### **GET 203 Engineering Drawing I (2 Units, LH 15, PH 45)**

Revision of multi-view representation. Harder examples of two and three view representation (1<sup>st</sup> and 3<sup>rd</sup> angles). Harder examples on isometric drawing to include simple pictorial assembly drawing in isometric. Harder examples on oblique drawing (Cavalier, Cabinet and Angles other than 45 degrees). Dimensioning. Sections and Conventions. Auxiliary views. Representation and specifications of threads. Bolted joints. Keys and cotter-joints. Conventional representations. Engineering drawing techniques: Geometrical Constructions, Principles of Tangency. Orthographic Projections: Auxiliary views, Interpenetration & Development. Sectional Views and Dimensioning. Isometric Projection. (See BS 308/8888).

### **GET 205 Workshop Practice (1 Unit, PH 45)**

Introduction to basic equipment in wood, machine, fitting and welding workshops. Element of safety practice with the various tools used in the workshops. Discussion on general safety precautions. General principles governing the various workshop machines. Selection and use of tools for specific operations in the various workshops. Practical demonstration of use of tools and machines in performing basic workshop processes. Introduction to practices and skills in general engineering through instruction in operation of hand and powered tools for wood and metal cutting and fabrication. Supervised hand-on experience in safe usage of tools and machines for selected tasks.

### **GET 207 Engineering Mechanics I (3 Units, LH 45)**

Forces, moments, couples. Equilibrium of simple structures and machines parts. Friction. First and second moments of area; centroids. Kinematics of particles and rigid bodies in plane motion. Newton's laws of motion. Kinetic energies and momentum analysis.

### **GET 209 Engineering Mathematics I (3 Units, LH 45)**

Limits, continuity, differentiation, introduction to linear first order differential equations, partial and total derivatives, composite functions- matrices and determinants, vector Algebra, Vector Calculus, Directional derivatives.

### **GET 211 Engineering Materials (3 Units, LH 45)**

Introduction to electronic configuration, atomic structures, inter atomic bonding mechanisms, crystal, and microstructure. Relationships between structure and properties of metals, alloys, ceramic and plastics. Principles of the behaviour in common

environments. Fabrication processes and applications. Fundamentals of structure, energetics, and bonding that underpin materials science. Topics include: an Introduction to thermodynamic functions and laws governing equilibrium properties, relating macroscopic behaviour to atoms and molecules of materials; the role of electronic bonding in determining the energy, structure, and stability of materials; quantum mechanical descriptions of interacting electrons and atoms; materials phenomena, such as heat capacities, phase transformations, and multiphase equilibrium to chemical reactions and magnetism; symmetry properties of molecules and solids; structure of complex, disordered, and amorphous materials; tensors and constraints on physical properties imposed by symmetry; and determination of structure through diffraction. Real-world applications include engineered alloys, electronic and magnetic materials, ionic and network solids, polymers, and biomaterials.

### **GET 213 Fundamentals of Thermodynamics**

**(3 Units, LH 30, PH45)**

Introductory survey of thermodynamics. What is Thermodynamics? Historical background, scope of thermodynamics, dimensions, and units. Fundamental concepts: systems, control volume, properties and states, processes, heat and work, pressure, temperature and the zeroth law. Elementary form of the continuity equation. The first law of thermodynamics and its corollaries: conservation of energy, internal energy, and enthalpy, thermodynamic properties of pure substances: P-V-T relations and diagrams, the ideal gas property tables, and charts. The second law of thermodynamics and its corollaries: Reversibility, Irreversibility, Efficiency, and thermodynamic temperature scale. Entropy. Clausius inequality, heat engines and heat pumps. Basic concepts, quantitative relationship of Zeroth, first, second and third laws of thermodynamics. Behaviour of pure substances and perfect gases. Ideal gas cycles.

### **ENT 201 Entrepreneurship I**

**(2 Units: LH30)**

1. Mapping the Journey - This module introduces the basics of starting a business by explaining different types of business structures, legal and tax considerations, and how to test your idea. a) Introduction to Entrepreneurship/Finding the right idea; b) Types of Entrepreneurship; c) How to set up the business; d) Value Proposition; e) Product Development.
2. Model - how to organize your business, protect your ideas, and communicate them to others. a) IP Management; b) Business Model Canvas.
3. Market - This module defines the process of identifying your target market, preparing to enter the marketplace and how to communicate value to your customers. a) Analysing the Market; b) Market Communication; c) Idea to Market; d) Sales; e) Negotiation.
4. Management - This module outlines a company's organizational structure, how to recruit and manage talent, and organize your finances. a) Budgeting/Financial Planning; b) Recruiting; c) Boot strapping.
5. Money - This module addresses various financing methods available to start-ups, including how to prepare a good investor pitch. a) Raising Funds; b) The Pitch.

**GST 202 Philosophical Anthropology**

**(2 Units, LH 30)**

An introduction to the philosophical basis of considerations about the human person. The course seeks to establish what the human person is. With the aim of bringing the students to a due appreciation of the human reality, a study will be made of the human potencies and faculties, such as the understanding, the imagination, and the will. Particular attention will be paid to human rationality and freedom, qualities which, among others, set the human person apart from other material beings. Fundamental questions about the relations between human nature, religion and culture, as well as the basis of the dignity of the human person will also be dealt with. A study will also be made of various conceptions of the person which are based on ideology.

**GST 211 Environment and Sustainable Development**

**(2 Units, LH 30)**

Man - his origin and nature; Man, and his cosmic environment; scientific methodology, Science and Technology in the society and service of man. Renewable and non-renewable resources –man and his energy resources. Environmental effects of chemical plastic, textiles, Wastes and other materials. Chemical and radiochemical hazards. Introduction to the various areas of science and technology. Elements of environmental studies.

**DETAILED COURSE DESCRIPTION 200-LEVEL - SEMESTER II**

**GET 202 Fundamentals of Electrical Engineering II**

**(3 Units, LH 30, PH45)**

Basic machines- DC, synchronous alternators, transformers, equivalent circuits. Three phase balanced circuits, PN junction diode, Transistors, Thyristors, FETs, Zener, and Rectifiers. Basic control systems, open/close loop systems. Communication fundamentals, introduction to TV, Radio, Telephone systems.

**GET 206 Fundamentals of Fluid Mechanics I**

**(3 Units, LH 30, PH45)**

Properties of Fluids, Fluid statics, Basic conservation laws, friction effects and losses in laminar and turbulent flows in ducts and pipes. Dimensional analysis and dynamic similitude, principles of construction and operation of selected hydraulic machinery, Hydropower systems.

**GET 208 Strength of Materials**

**(3 Units, LH 30, PH45)**

Consideration of equilibrium; composite members, stress-strain relation. Generalized Hooke's Law. Stresses and strains due to loading and temperature changes. Torsion of circular members. Shear forces, bending moments and bending stresses in beams with symmetrical and combined loadings. Stress and strain transformation equations and Mohr's circle. Elastic buckling of columns. Force equilibrium – free body diagrams. Concept of stress, strain; tensile test. Young's moduli and other strength factors. Axially loaded bars, composite bars, temperature stresses and simple indeterminate problems. Hoop stresses in cylinders and rings. Bending moment, shear force and axial force diagrams for simple cases, Simple torsion, and application.

**GET 210 Engineering Mathematics II**

**(3 Units, LH 45)**

Second order differential equations, line integral, multiple integral and their applications, differentiation of integral. Analytical functions of complex variables. Transformations and mapping, special functions-

**GET 212 Fundamentals of Computer Aided Engineering I**

**(3 Units, LH 30, PH45)**

Introduction to computers and computing. Problem solving on Computer algorithms design using flowchart and pseudo-code. Introduction to high level programming languages, C syntax, flow of control, input/outputs construct, data types. Programming in C. Extensive exercises in solving engineering problems using flowchart and pseudo-code. Introduction to software for solving simple engineering analysis problems such as FEA, CFD, etc

**GET 222 Engineering Drawing II**

**(2 Units, LH 15, PH 45)**

Cams. Interpretation of solids. Development of surfaces. Detail drawing, Belts, Chain, gears. Bearing and lubrication arrangements, Coupling breaks, Flexibles shafts, Universal joints, etc. Assembly drawings. Revisions.

**GET 224 Engineering Communication**

**(2 Units, LH 30)**

Professional use of English language for letters, specification descriptions, presentation of charts, graph tables, writing of proposals in reports. Case studies of major engineering designs and construction/fabrication as well as industrial failures; professional presentation of reports and proposals.

**ENT 202 Entrepreneurship II**

**(2 Units, LH 30)**

The work in this course is fully practical. Each group made up of between six and ten students will be given as seed capital the naira equivalent of \$250. Each group will register their business, open a bank account, mobilise additional funds and run the business throughout the semester. At the end of the semester, the business will be officially liquidated, the seed capital returned to EDC and the profit donated to a charity of their choice or used to improve the community around the University. At the very least, each group MUST break even and return the seed capital. A report will be submitted by each group focusing on how they have been able to use entrepreneurial principles learnt in ENT 201 and, more importantly, what they have learnt during their entrepreneurial journey.

**GST 204 Peace studies, Conflict Resolution & Ethics**

**(3 Units, LH 45)**

Basic Concepts in peace studies and conflict resolution; Peace as vehicle of unity and development; Conflict issues; Types of conflict, e. g. Ethnic/religious/political/ economic conflicts; Root causes of conflicts and violence in Africa; Indigene/settler phenomenon; Peace – building; Management of conflict and security. Elements of peace studies and conflict resolution; Developing a culture of peace; Peace mediation and peacekeeping; Alternative Dispute Resolution (ADR). Dialogue/arbitration in conflict resolution; Role of international organizations in conflict resolution, e.g., ECOWAS, African Union, United Nations, etc.

**GET 299 Students Industrial Work Experience SIWES - I (6 Units, 12 weeks)**

On the job experience in industry chosen for practical working experience but not necessarily limited to the student's major (8 weeks during the long vacation following 200 levels). In view of the problems being experienced in the operation of SIWES arising from limited places for meaningful industrial attachment outside the universities, PAU will have to run SWEP I (Students' Work Experience Programme I), involving the in-house exposure of 200-Level students to the use of various workshop tools and machines, electrical works, maintenance and repair of electrical equipment, woodwork, welding practice, etc. Experience must be on project-based work with engineering design content.

## **DETAILED COURSE DESCRIPTION 300-LEVEL - SEMESTER I**

### **MEE 307 Theory of Machines I (3 Units, LH 30, PH 45)**

Simple mechanisms and their analysis; Vector diagrams; Simple harmonic motion; Newton's Laws of motion; Force analysis of mechanism; friction effect; analysis and applications; Theory of Structures; Dynamics of linear systems; Balancing; Gear systems and Gear trains; Rigid body; Introduction to tribology.

### **MEE 309 Thermodynamics - II (3 Units, LH 30, PH 45)**

Ideal air cycles. Introduction of Internal Combustion Engines; Reciprocating air compressors and other positive displacement compressors. Gas and vapour power cycles, refrigeration cycles, vapour compression units, principles of absorption refrigeration. Testing of various heat engine plants.

### **MEE 313 Engineering Technology (2 Units, LH 15, PH 45)**

Workshop setting; Types of Workshop equipment, machines, and materials; Use of instruments and Tools, Machine operation Practice; Safety procedures in Workshops.

### **MEE 315 Control Systems (3 Units, LH 45)**

Control Engineering concepts; Transfer Function; Differential equation of Control Systems; transducers; Automatic Control Methods.

### **MEE 331 Engineering Drawing III (3 Units, LH 15, PH 90)**

Introduction to AutoCAD. Using AutoCAD to produce 2D and 3D drawings. Descriptive Geometry. Limits and fits. Geometric tolerances, Welding drawings and Design. Redesigning of casts components using welded joints. Harder examples on exploded assembly drawings (e.g., a complete gear box in exploded assembly drawings). Arrangements of engineering components to form a working plant (Assembly drawing of a plant). Revision.

### **EEE 301 Electronic Circuits I (Analogue) (2 Units, LH 30)**

Semiconductor devices – models, characteristics and applications, small signal amplifiers, Audio amplifiers, class A, AB, B, C, and push-pull design. Operational amplifiers, Feedback amplifiers. Oscillators, power amplifiers, tuned amplifier. Wave shaping sequential circuits, definition, and characteristics and design. Flip flops, memory circuits, logic families-TTL, ECL, RTL, DTL, LSI, VLSI digital systems design. Review of single-stage transistor amplifiers using BJTs and EETs Equivalent circuit and calculation of current gain, voltage gain, power gain, input, and output impedance. Operational Amplifiers: Parameters and applications. Feedback, Broadband and narrowed band amplifies. Power amplifiers. Voltage and current stabilizing circuit. Voltage amplifiers, multi storage amplifier. Using BJTs and FETs.

### **GET 301 Engineering Mathematics III (3 Units, LH 45)**

Linear Algebra. Elements of Matrices, Determinants, Inverses of Matrices, Theory of Linear Equations, Eigen Values and Eigen Vectors, Analytical Geometry, Coordinate

transformation, Solid Geometry, Polar, Cylindrical and Spherical coordinates. Elements of functions of several variables, Surface variables. Ordinary Integrals. Evaluation of Double Integrals, Triple integrals, Line integrals and Surface Integrals. Derivation and integral of Vectors, The gradient of Scalar quantities. Flux of Vectors, The curl of a Vector Fields. Gauss, Greens and Stokes' Theorems an Applications. Singular Valued Functions. Multivalued Functions, Analytical Functions, Cauchy Riemann's Equations. Singularities and Zeroes, Contour integration including the use of Cauchy's Integral Theorems. Bilinear Transformation.

**GET 303 Engineer in Society & Professional Ethics (2 Units, LH 30)**

Philosophy of Science and Engineering. History of Engineering and Technology. The engineering profession – engineering - engineering literacy professional bodies and engineering societies. Engineers' conduct and ethics. Engineers and nation building – economics, politics, business, safety in Engineering and introduction in Risk analysis. Invited lectures of professionals.

**GST 303 Nigerian Peoples and Culture: (2 Units, LH 30)**

Study of Nigerian history, culture, and arts in pre-colonial times; Nigerian's perception of his world; Culture areas of Nigeria and their characteristics; Evolution of Nigeria as a political unit; Indigene/settler phenomenon; Culture is a way of life and persons are defined by the cultures within which they live. An understanding of persons thus requires a knowledge of their culture. The course studies the ways of life of people in Nigeria. It examines the customs, traditions, beliefs, and values of various groups. While particular emphasis shall be placed on the various cultures found within Nigeria, a survey of the history and culture of people of the great empires of ancient and pre-colonial Africa will be made, together with a study of Africa today and the African image in the contemporary world. Concepts of trade; Economic self-reliance; Social justice; Individual and national development; Norms and values; Negative attitudes and conducts (cultism and related vices); Re-orientation of moral; Environmental problems.

**DETAILED COURSE DESCRIPTION 300-LEVEL - SEMESTER II**

**MEE 308 Manufacturing Technology (2 Units, LH 15 PH 45)**

Fabrication methods; Casting and pattern design; Forging and Extrusion; Welding methods; Use of drilling, boring, grinding and other material processing machines; Foundry work.

**MEE 310 Fluid Mechanics II (3 Units, LH 30 PH 45)**

Properties of fluids; Hydrostatics; fluid motion; momentum equation; Boundary Layer flow; Flow measurements; fluid operated machines; Rotodynamic machines; Fluid Power transmission; Pumps and pump design.

**MEE 312 Engineering Metallurgy**

**(2 Units, LH 30)**

Introduction to the electric structure of atom and matter. Solid State Crystallography. Relationship between structure and composition and mechanical and thermal properties of materials, alloys, plastics, ceramics and natural products. Heat treatment: Annealing, Normalizing, Tempering and Hardening. Metallic corrosion and protection. Manufacture and structure of high polymers. Thermoplastic and thermosetting resins.

**MEE 322 Metrology**

**(3 Units, LH 30, PH 45)**

Theory and practice of high precision. Mechanical measurements under strict control conditions. Super micrometry, comparator profilometry, collimators application in machine installations, etc. Tolerances and quality. Fits: Clearance, transition, and interference fits.

**MEE 324 Mechanics of Materials - I**

**(3 Units, LH 45)**

Deflection beams; Revision of method of solution; shear stress distribution and deflection due to shear centre. Unsymmetrical bending. Strain energy methods; Application to thin members and undetermined structures. Helical and leaf springs. Plastic bending of beams, buckling.

**EEE 302 Electronic Circuits II (Digital)**

**(2 Units, LH 30)**

Number Systems and Codes. Boolean algebra and truth table. Switching circuits. Electronic logic gates, basic functional components. Analysis of combinational circuits. Synthesis of combinational logic circuits. Karnaugh maps. K-maps of four or more variables. Simplification of switching functions. Computer-aided minimization of switching functions. Algebraic methods for determining prime implicants. Digital vs. analog systems. Mixed signal design, analogue and digital grounding. Digital system design hierarchy. Logic devices: TTL and CMOS families, technology, applications. Memory devices. Latches, Flip-flops. Modular Design. Decoders. Implementing Logic Functions Using Decoder. Encoder Circuit Structures. Multiplexer circuits. Computer-aided Design of Modular Systems.

**EEE 306 Electrical Machines - I**

**(2 Units, LH 30)**

Electromechanical energy conversion; emf equations, Synchronous machines, 3-phase alternator, instability, mathematical representation of characteristics, polar diagram. Synchronous motor: construction, characteristics, circuit diagram. Induction motor: construction, characteristics, torque/slip relation, speed control, induction generator, single phase induction motor application.

**MCT 302 Introduction to Robotics**

**(2 Units, LH 30)**

Automation and Robotics. Robot Classification. Robot Specifications. Direct Kinematics: Mathematical background. D-H representation. The Arm equation. Examples Inverse Kinematics: The inverse kinematics problem and its solution. Tool configuration. Examples of various robots. Introduction to Manipulator Dynamics: Lagrange's Equation, Lagrange-Euler Dynamic Model. Use of Sensors and Vision System in Robotic System

**GET 302 Engineering Mathematics IV**

**(3 Units, LH 45)**

Series solution of second order linear differential equations with variable coefficients. Bessel and Legendre equations. Equation with variable coefficients. Sturm-Liouville boundary value problems. Solutions of equations in two and three dimensions by separation of variables. Eigen value problems. Use of operations in the solution of partial differential equations and linear integral equations. Integral transforms and their inverse including Fourier, Laplace and Mellin and Heindel Transforms. Convolution Integrals and Hilbert Transforms. Calculus of finite differences. Interpolation formulae. Finite difference equations. Runge-Kutta and other methods in the solution of ODE and PDEs. Numerical integration and differentiation.

**GET 399 Students Industrial Work Experiences II (SIWES II)**

**(6 Units, 12 weeks)**

On the job experience in industry chosen for practical working experience but not necessarily limited to the student's major (12 weeks during the long vacation following 300 levels). Experience must be on project-based work with engineering design content.

## DETAILED COURSE DESCRIPTION 400-LEVEL - SEMESTER I

### **MEE 403 Applied Thermodynamics & Heat Transfer III (4 Units, LH 45 PH 45)**

General thermodynamics relations. Kinetic theory of gas. Mixture of gases, psychrometry, air-conditioning and cooling towers. Introduction to Heat Transfer.

### **MEE 405 Fluid Mechanics III (3 Units, LH 30 PH 45)**

Unsteady flow; Oscillations in U-tube; Surge tanks; Water hammer. Open-channel flows. Introductory concepts of boundary layer and re-circulating flows, Mathematical derivation of Navier-Stokes equations and its applications.

### **MEE 407 Theory of Machines II (3 Units, LH 30 PH 45)**

Vibration of Machinery. Free and forced vibration, damping, natural frequencies and critical speeds. Transverse vibrations of beams, whirling of shafts, torsional vibrations.

### **MEE 409 Machine Design I (3 Units, LH 45)**

Failure analysis; Various types of joints, design of machine elements; system design, Design of gear systems; Material selection in design; Design; Design and production matching; Optimisation in design.

### **MEE 411 Advanced Mechanics of Materials II (3 Units, LH 45)**

Thick cylinders; Compound cylinders. Rotating disks. Bending of flat plates. Beams on an elastic foundation. Membrane stresses in shells of revolution. Two-dimensional theory of elasticity. Elastoplastic problem, and limit theory.

### **MCT 411 Introduction to Mechatronics Engineering (2 Units, LH 30)**

Introduction to mechatronics, mechatronics education and mechatronics systems: Development and Future of Mechatronics Education; Definition of Mechatronics and application of Mechatronics in Industry; Definition and application of the synergy, Mechanical gear system, rack and pinion, worm and screw, and simple calculations. Electrical transformer as equivalent of mechanical gear. Introduction to analog and digital Components. Microcontrollers.

Sensors and Transducers: Performance Terminology, Sensors for Displacement, Position and Proximity; Velocity, Motion, Force, Fluid Pressure, Liquid Level. Temperature, Light Sensors, Selection of Sensors, Analogue sensors: pressure, temperature, linear displacement, angular displacement, rate gyro, acceleration, light sensors, infra-red sensors, hall effect sensors. Motion detection. Digital sensors: heading sensor, gps, gsm, compass, digital infrared sensor, shaft encoder, and their interfacing.

Actuators: DC motors, ac servo, stepper motor, ac motor, linear actuator, relays. Signal conditioning, introduction to adc and dac. Pneumatic and Hydraulic Systems – Directional

Control Valves – Rotary Actuators. Electrical Actuation Systems – Mechanical Switches – Solid State Switches – Solenoids.

Rapid Prototyping & MEMS: Hands-on Programming CNC machine and 3D-Printing, MEMS. Electronics and hardware components for mechatronics - Computer interfacing, hardware for digital/analog interfacing, devices for data conversion advances applications - Topics may be chosen from the following: fuzzy logic control, adaptive control techniques and applications, intelligent supervisory control in process systems, condition monitoring methods and examples, performance evaluation and fault finding.

**GET 401 Cost Engineering**

**(2 Units, LH 30)**

Cost and schedule management- an engineering function. Supporting skills and knowledge. Role of cost engineer during evaluation phase. Role of cost engineer during the basic design phase. Role of cost engineer in contractor selection. Role of cost engineer during detailed engineering design phase. Role of cost engineer during construction. Cost engineering function as distinct from Design engineering function. Canon of ethics for cost engineers. Basic capital cost estimating. Basic operating cost estimating. Basic project planning and scheduling. Cost engineering terminology. Cost engineering standards.

**GET403 Engineering Economics**

**(3 Units, LH 45)**

The nature and scope of economics. Basic concepts of engineering economy. Interest formulae. Discounted cash flow, present worth, equivalent annual growth, and rate of return comparisons. Replacement analysis. Breakdown analysis. Cost-Benefit Analysis. Minimum acceptable rate of return. Judging attractiveness of proposed investment.

**DETAILED COURSE DESCRIPTION 400-LEVEL - SEMESTER II**

**GET 499 SIWES III**

**(6 Units, 24 weeks)**

On the job experience in industry chosen for practical working experience but not necessarily limited to the student's major (24 weeks from the end of First semester at 400 levels to the beginning of the First Semester of the following session. Thus, the second semester at 400-level is spent in industry). Experience must be on project-based work with engineering design content.

## **DETAILED COURSE DESCRIPTION 500-LEVEL - SEMESTER I**

### **MEE 501 Applied Thermodynamics IV (3 Units, LH 30 PH 45)**

Availability of open closed systems and heat reservoirs. Chemical reactions. Gibbs functions. Chemical equilibrium. Centrifugal and axial flow compressors. Turbine theory, velocity diagrams, degree of reaction, impulse efficiency, reheat factor. Combustion and product analysis.

### **MEE 503 Heat Transfer V (3 Units, LH 30, PH 45)**

Conduction: Steady and unsteady conduction; Numerical methods. Convection; free and forced convection for laminar and turbulent flows. Thermal radiation. Heat exchangers. Mass transfer processes. Solar energy applications.

### **MEE 505 Engineering Design Processes (2 Units, LH 30)**

Introduction to elements of design process including strategic planning project management, modelling, materials selection, engineering economics, safety, environmental issues, and ethics.

### **MEE 511 Tribology (2 Units, LH 30)**

Theories of friction between metallic, non-metallic, dry and lubricated surfaces. Testing and properties of materials; Solid and liquid lubricants. Theory of self-acting and pressurized bearings, including Reynolds equation and solutions, dynamic loading, temperature, and pressure effects on viscosity. Elasto-hydrodynamic lubrication, gears and rolling contact bearings. Design of journal and thrust bearing.

### **GET 501 Engineering Management (3 Units, LH 45)**

Principles of Organization; elements of organization; management by objectives. Financial management, accounting methods, financial statements, cost planning and control, budget, and budgetary control. Depreciation accounting and valuation of assets. Personnel management, selection, recruitment and training, job evaluation and merit rating. Industrial Psychology. Resource management; contracts, interest formulae, rate of return. Methods of economic evaluation. Planning decision making; forecasting, scheduling. Production control. Gantt chart, CPM and PERT. Optimization linear, materials handling. Raw materials and equipment. Facility layout and location. Basic principles of work study. Principles of motion economy. Ergonomics in the design of equipment and process.

## **ELECTIVES (Up to 6 Units)**

### **MEE 507 Theory of Elasticity (4 Units, LH 45, PH 45)**

Application of Theory of Elasticity to two- and three- dimensional problems in Engineering; Stress concentration in round holes; Discs, wedges under point loading, etc. Experimental stress analysis, strain gauging, photo-elasticity and holography. Approximate methods; Finite Element method.

**MEE 509 Fracture of Structural Materials**

**(4 Units, LH 45 PH 45)**

Conventional design concepts in relation to fracture; the mechanics of fracture. Designing and testing for fracture resistance. Microscopic aspect of fractures. Fracture of specific materials. Fatigue.

**MCT 501 Automation and Robotics**

**(2 Units, LH 15, PH 45)**

Introduction to automation: Economics of Automation, Flow Lines, Mathematical Models, Storage Buffers, Partial Automation, Balancing, Group Technology and Flexible Manufacturing. Programmable Logic Controllers Introduction to PLCs, Advantages of PLCs, Ladder Logic Diagrams, Switching Logic. Components of PLC, PLC Operating Cycle, Additional Capabilities of a PLC, Latches, Design Cases (Deadman Switches, Conveyor, Accept/Reject Sorting), Addressing. PLC connection, PLC operation, Numbering, Event based logic, sequential logic design, Advanced ladder logic functions. PLC Programming, Structured text programming, Instruction list programming, Function block programming, Continuous control, PLC data communication, Human Machine Interfaces (HMI). Selecting a PLC.

**DETAILED COURSE DESCRIPTION 500-LEVEL - SEMESTER II**

**MEE 502 Fluid Dynamics**

**(3 Units, LH 45)**

Mathematical theory of the motion of inviscid fluids. Laminar and turbulent boundary layers, and wakes. Theory of turbulence models, isotropic wall and free turbulence.

**MEE 504 Machine Design II**

**(4 Units, LH 30, PH 90)**

Creative application of the design process to engineering problems with emphasis of the manufacture of complete systems to accomplish general objectives of minimum weight and high efficiency while satisfying the design constraints. Use and evaluation of several CAD/CAM software packages.

Students will gain experience with CAD/CAM software while carrying out an actual manufacturing design project.

**MEE 512 Turbomachinery**

**(2 Units, LH 30)**

Moment of momentum for turbines, compressors, pumps, fans. Performance characteristics of turbines, etc. Specific speed. Matching of pump and load. Cascade theory, including Mach number effects.

**GET 502 Engineering Law**

**(3 Units, LH 45)**

Common law: Its history, definition, nature and division. Legislation, codification, interpretation. Equity: Definition and its main spheres. Law of contracts for Engineers: offer, acceptance, communication, termination. General principles of criminal law. Law of torts: definition, classification, and liabilities. Patents, requirements, application and

infringements. Registered designs: application, requirements, types and infringement. Company law. Labour law and Industrial Law.

**GET504 Engineering Valuation/Appraisal (2 Units, LH 30)**

Objectives of valuation work/ valuer's primary duty and responsibility. Valuer's obligation to his or her client, to other valuers, and to the society. Valuation methods and practices. Valuation reports. Expert witnessing. Ethics in valuation. Valuation standards. Price, cost, and value. Depreciation and obsolescence. Valuation terminology. Appraisal reporting and review. Real property valuation. Personal property valuation. Machinery and equipment valuation. Oil and gas valuation. Mines and quarries valuation.

**ELECTIVES (Up to 4 Units)**

**MEE 510 Plasticity (2 Units, LH 30)**

Fundamentals of Plasticity; Stress and Strain relations; Yield criteria. Various approximate methods applied to elastoplastic problems of bending of beams and torsion of bars. Plastic limits design.

**MCT 512 Process Automation (2 Units, LH 15, PH 45)**

PLC programming higher functions: - PLC-programming analogue in/outputs, 2-step controller. Basics in closed loop control, Closed loop temperature control, Closed loop pressure control, Closed loop flow control, - Closed loop level control

**TAE 504 Automotive System Design (2 Units, LH 30)**

Auto Engine design; Design of steering systems; Design of transmission systems.

**MEE 599 Project (Student Capstone Project) (6 Units, PH 270)**



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