UNIVERSITY OF AGRICULTURE AND ENVIRONMENTAL SCIENCES, UMUAGWO

B.Eng. Mechanical Engineering

CCMAS-BASED STUDENTS' HANDBOOK

1.0 LOGO / MOTTO OF UAES

1.1 UAES Logo

1.2 MOTTO OF UAES

Innovation, Excellence & Service

2.0 VISION STATEMENT OF UAES

The vision of the University of Agriculture and Environmental Sciences is 'to become a leader in the discovery, dissemination and application of new knowledge in areas of Agriculture and Environmental Sciences for the development of self and of society'.

3.0 MISSION STATEMENT OF UAES

The mission of the University of Agriculture and Environmental Sciences is 'to provide excellent and conducive environment for teaching, learning, research, and service that shall be renowned, distinguished and attractive nationally and internationally'.

4.0 PHILOSOPHY AND ASPIRATION OF UAES

To encourage the advancement of learning in Imo State in particular, Nigeria and humanity in general and

To holdout to all persons, without distinction of race, creed, or sex, the opportunity of acquiring higher and sound education.

5.0 THE NATIONAL ANTHEM OF NIGERIA

Arise, O compatriots, Nigeria's call obey
To serve our fatherland
With love and strength and faith
The labour of our heroes past
Shall never be in vain
To serve with heart and might
One nation bound in freedom, peace and unity.

6.0 THE NATIONAL PLEDGE

I pledge to Nigeria my Country
To be faithful, loyal and honest
To serve Nigeria with all my strength
To defend her unity
And uphold her honour and glory
So help me God.

7.0 UAES ANTHEM

1st Stanza

University of Agriculture and Environmental Sciences
The home of knowledge, innovation and excellence
The pride of the eastern heartland and star of the nation
We create a better tomorrow by grooming scholars and leaders
Beyond boundaries of race, creed and gender.

Refrain:

UAES!!! Eagles of the world
Brilliant and bright, we'll always shine
We pledge to lead by excellence
UAES!!! Eagles of the world.

2nd Stanza

Mother Nature! We care and cherish you, "A gift to us from the Creator"
We pray for light and wisdom, to preserve, protect and sustain thee
May we grow each day in knowledge, intuition and moral strength
That through all our efforts, innovations and discoveries
The earth will be renewed, and become a better place.

8.0 NAMES OF THE PRINCIPAL OFFICERS OF UAES

Principal Officers of the University

i. AG. VICE CHANCELLOR
PROF. CHRISTOPHER CHIEDOZIE EZE
B.Agric. (Hons) MSc., PhD (Nig) L.L.B., B.L., Dip. in SMEs, FNAAE, FFAMAN, FASN, EMF

ii. REGISTRAR
PRINCE E. E. NJEMANZE
B.A (HONS), PGDIS, MBA FCAI

iii. BURSAR
ROBERT N. ANIKPUTA
MBA, MSC, FCA

iv. **UNIVERSITY LIBRARIAN**
PROF. (MRS) C. C. NWOSU
BLS, MLS, Ph.D

Ag. Dean of Faculty of Engineering

Engr. Dr. Monday M. Chukwu

B. Eng., M.Eng., PhD. MNSE, MNSChE, COREN Registered

9.0 NAMES OF ACADEMIC AND NON-ACADEMIC STAFF OF THE DEPARTMENT AND THEIR QUALIFICATION

STAFF LIST OF MECHANICAL ENGINEERING DEPARTMENT

S/N	Full Name	Academic Qualifications	Designation	Area of specialization
1,	**Ohwofadjeke** Paul Ogheneochuko	BSc, M.Eng, Ph.D, COREN R 50078	Lecturer I	Energy & Power Thermo-fluids and Equipment Development
2.	**Ononogbo** Chibuike	B.Eng, M.Eng, Ph.D, COREN R.42573	Lecturer I	Energy & Power Thermo-fluids
3.	**Njokuocha** Ugochukwu Joshua	B.Eng. M.Eng.	Asst. Lecturer	Energy & Power
4.	**Offurum** Michael Uzoamaka	B.Eng	Technologist I	Materials And Metallurgical Engineering
5	**Onye** Uche Chima	HND	Technologist II	Mechanical Production

10.0 BRIEF HISTORY OF THE DEPARTMENT

University of Agriculture and Environmental Sciences (UAES), Umuagwo is a public University established by an Act of Imo State Parliament Law No. 4 of 2019 and Amended Law No. 7 of 2020, official Gazette No. 20, Vol. 44. The University is approved and licensed by the National Universities Commission (NUC) as the 49th State University in Nigeria and 171st in the Federation, in 2019, to run 29 programs under five faculties and one of it is the faculty of Engineering.

Engineering is the application of the principles of mathematics and physical sciences to the solution of problems associated with physical materials, with a view to combating the forces of nature, for the benefit of mankind. Engineering is one of the few vocations recognized worldwide as a profession. Any aspiring student who wants to make a career in Engineering profession must ask himself/ herself these two questions: "why be an engineer?" and what does it take to be an engineer?" The first question needs to be explained to him/her in such a manner that would enable him/her appreciate what an engineer does. As an engineer, you get a chance to solve important problems confronting your communities, local government areas, cities, countries and the world at large. And for what it takes to be an engineer, it is important to state that not any kind of person can study Engineering. Curiosity to solve problems makes you a great Engineer with proper command of mathematics and physical sciences. There is a specific branch of Engineering for every interest so as to nurture Engineers with requisite knowledge in any chosen branch. Here at the Faculty of Engineering, University of Agriculture and Environmental Sciences, Umuagwo, Imo State, we presently have five branches/ departments in engineering namely: Chemical and Petroleum, Mechanical, Civil, Electrical/Electronics, Water and Irrigation engineering. Considering the blue prints of the Faculty, there is every opportunity for our programs to grow in number and strength to meet new challenges and societal needs.

The Engineering programs commenced with the admission of 2021/2022 set of students. All programs have essentially the same courses at Levels 100 and 200 except for the introductory courses to each of the programs at 200 level. All the twenty-four (24) courses at 100 Level are the same for all programs. At Level 200, all the seventeen (17) courses, except for three, are the same for all programs. At Level 300 and 400, both programs have seven (7) common courses with no common course in final level. Electives are provided to enable students acquire broader knowledge of the disciplines.

Given the versed nature of Mechanical Engineering, three options are made available from which a student is required to choose in his/her fourth (4th) year where he or she will major in the course of his/her engineering practice. The options are: Air Conditioning and Refrigeration Engineering Technology, Automotive Engineering and Industrial Production Engineering.

11.0 TABLE OF CONTENTS

12.0 OVERVIEW OF THE DEPARTMENT AS STATED BY NUC (CCMAS)

Mechanical engineering is the application of the principles of physics (namely of motion, energy, and force), mathematics, materials science and engineering problem-solving techniques to the design, analysis, manufacture, operation and maintenance of mechanical systems while ensuring competitive costing, safety, reliability and efficiency of such systems. The mechanical engineering discipline employs contemporary design tools such as computer-aided design (CAD), computer-aided manufacturing (CAM), and product lifecycle management tools to analyse and design a wide variety of systems.

This curriculum is designed in line with contemporary global trends in Mechanical Engineering education; emphasising development of materials, mass, momentum and energy balances leading to the geometric description of conservation laws of nature. These lead to several important constitutive models and multiphysics in special fields such as:

i. Linear and nonlinear mechanics Applied (solid) Mechanics (involving the analysis of the behaviour of solid bodies subjected to external loads, stresses and/or vibrations and using the information in the design and manufacture/construction of such bodies).
ii. Fluid Mechanics (involving the analysis of the behaviour of liquids and gases and employing the knowledge in the design and development of machinery and systems that can and/or do influence that behaviour – pumps, fans, turbines, piping systems, et cetera).
iii. Thermal Engineering [including Thermodynamics and Heat Transfer] (involving the analysis of the conversion of thermal energy into work and/or other forms of energy and thermal energy transport and employing this knowledge in the design and development of energy conversion devices and systems, e.g., power plants, engines, heating, ventilation & air conditioning (HVAC) systems, etc.).
iv. Mechanical Design and Manufacturing Engineering (covering the full range of mechanical-based products and systems); arising from the above engineering sciences synthesized together into modern software solutions of the resulting complex equations that, added to 3D Solid models, simulation analysis and optimization produce useful design tools.
v. Industrial Engineering and Management Science.

13.0 PHILOSOPHY OF THE PROGRAMME AS STATED BY NUC (CCMAS)

The philosophy of the programme is to produce self-reliant and confident graduates who can bring their academic and practical backgrounds to bear on the problems of industry and the larger Nigerian society. The academic programme has been planned to challenge and encourage students towards developing ingenuity and originality in problem solving. The cornerstone of this is an early grounding in the basic engineering sciences and a strong emphasis on applied design in later years.

14.0 OBJECTIVES OF THE PROGRAMME AS STATED BY NUC (CCMAS)

i. Actively engage in engineering practice or in other fields, such as education, science, business, public policy, politics or governance for sustainable development;
ii. Retain intellectual curiosity that will motivate them to pursue meaningful lifelong learning via graduate education in engineering or related fields, participation in professional development and/or industrial training courses, and/or obtain engineering certification;
iii. Develop successful careers as mechanical engineers and apply their mechanical engineering education to address the full range of technical and societal problems with professional engineering competence, creativity, imagination, confidence and responsibility;
iv. Occupy positions of increasing responsibility and/or assignments and aspire to positions of leadership within their profession for enhanced community participation and qualitative service delivery; and
v. Exhibit the highest ethical and professional standards, and, as agents of positive change, communicate the importance and excitement of mechanical engineering.

15.0 EMPLOYABILITY SKILLS AS STATED BY NUC CCMAS

Graduates of this programme may find jobs in diverse sectors as:

i. In the automobile, aerospace, biomedical, building and construction, food and beverages, manufacturing, oil and gas, power, petrochemical and process, railway and telecommunication industries;
ii. Industrial systems engineers, product designers, managers, researchers, applied mathematicians, and, of course, performing a multitude of other traditional mechanical engineering duties; and
iii. To become entrepreneurs (employers of labour in field relating to mechanical engineering).

The curriculum is designed to:

i. Equip graduates of the Mechanical Engineering programme with the intellectual capacity (to apply the principles of physics, mathematics, materials science and engineering problem-solving techniques) and relevant contemporary skills;
ii. Offer students skills that are highly sought after and highly remunerated in industry;
iii. Prepare graduates to undertake the challenge of working on a wide range of projects, with the prospect of working with a broad spectrum of other professionals; and
iv. Develop successful careers as mechanical engineers and apply their mechanical engineering education to address the full range of technical and societal problems with professional engineering competence, creativity, imagination, confidence and responsibility.

16.0 21st CENTURY SKILLS AS STATED BY NUC (CCMAS)

The programme emphasises such contemporary skills as:

i. Developing ingenuity and originality in critical thinking/ problem solving/decision making;
ii. Creativity and innovation;
iii. Information literacy;
iv. Intellectual curiosity that will motivate them to pursue meaningful lifelong learning;
v. Contemporary software proficiency;

vi. Effective communication skills;
vii. Entrepreneurial capability;
viii. Collaboration (teamwork and work ethic);
ix. Flexibility and adaptability; and
x. Learning how to learn/metacognition

17.0 JOB OPPORTUNITY

Some of the job role that are available to Mechanical Engineering graduates include but not limited to:

i. **Mechanical Engineer:** This is the most obvious and common role for mechanical engineering graduates. They design, develop, build, and test mechanical devices, including tools, engines, and machines.
ii. **Product Design Engineer:** These engineers work on the design and development of new products, focusing on functionality, aesthetics, and manufacturability.
iii. **Manufacturing Engineer:** Responsible for improving and optimizing manufacturing processes, ensuring efficiency, quality, and cost-effectiveness.
iv. **Quality Engineer:** Ensures that products meet quality standards and specifications by implementing quality control procedures and conducting inspections and tests.
v. **Project Engineer/Manager:** Manages engineering projects from conception to completion, including planning, budgeting, scheduling, and coordinating activities of team members.
vi. **Research and Development (R&D) Engineer:** Works on innovative projects to develop new technologies, products, or processes, often in collaboration with scientists and other engineers.
vii. **Energy Engineer:** Focuses on energy efficiency, renewable energy systems, and sustainable design practices to reduce environmental impact.
viii. **Automotive Engineer:** Designs and develops automotive systems and components, such as engines, transmissions, chassis, and electrical systems.
ix. **Aerospace Engineer:** Works on the design, development, and testing of aircraft, spacecraft, and related systems and components.
x. **Heating, Ventilation, and Air Conditioning (HVAC) Engineer:** Designs and oversees the installation of HVAC systems for buildings, ensuring comfort, energy efficiency, and indoor air quality.
xi. **Biomedical Engineer:** Applies engineering principles to the design and development of medical devices, prosthetics, and healthcare technologies.
xii. **Consulting Engineer:** Provides expert advice and solutions to clients on various engineering projects and challenges.
xiii. **Sales Engineer:** Combines technical knowledge with sales skills to promote and sell engineering products and solutions to customers.
xiv. **Maintenance Engineer:** Ensures the proper functioning and maintenance of mechanical systems and equipment in industrial facilities.
xv. **Materials Engineer:** Studies the properties and behavior of materials to develop new materials or improve existing ones for specific applications.
xvi. **Process Engineer:** Designs and optimizes industrial processes to improve efficiency, productivity, and quality.
xvii. **Robotics Engineer:** Designs, builds, and programs robotic systems for various applications, including manufacturing, healthcare, and exploration.

xviii. **Supply Chain Engineer:** Optimizes supply chain processes, logistics, and inventory management to ensure smooth and cost-effective operations.

xix. **Instrumentation and Control Engineer:** Designs and implements control systems for mechanical and industrial processes, ensuring automation and efficiency.

xx. **Academic/Researcher:** Pursues advanced degrees and conducts research in mechanical engineering fields at universities, research institutions, or corporate R&D centers.

These are just a few examples, and there are many other specialized roles and industries where mechanical engineering graduates can find opportunities in the global job space.

18.0 UNIQUE FEATURES OF THE PROGRAMME

Some unique features of the programme include:

i. Stimulating intellect and encouraging students towards developing ingenuity and originality in problem solving;

ii. Encouraging students to maintain intellectual curiosity that will motivate them to pursue meaningful lifelong learning; and

iii. Equipping students with the relevant intellectual capacity, contemporary software proficiency, communication, entrepreneurial and

iv. Other relevant soft skills like teamwork, flexibility, adaptability and interpersonal knack to engage effectively in engineering practice, business and in leadership roles.

19.0 ACADEMIC PROGRAMMES, DURATION AND ADMISSION (SEE ACADEMIC REGULATIONS FOR UNDERGRADUATE STUDENTS)

19.1 Mechanical Engineering Program Structure

The department of Mechanical Engineering is structured to have five academic calendar years (of ten semesters) of which nine of the ten semesters are actually used for requisite training in class room/laboratory studies. One semester (in the fourth year) and the two long vacations (at the end of third and fourth year) are used for industrial training known as Students' Industrial Work Experience Scheme. At the fifth year of studies, students are assigned research project topics and design project topics which they are expected to defend at the end of the tenth semester under an external examiner not below the rank of a Professor in Mechanical Engineering.

19.2 Minimum Duration of Program

The minimum duration of Engineering and Technology programs is five academic sessions for candidates who enter with Senior Secondary School Certificate or GCE 'O' Level qualifications. Candidates with relevant passes in Mathematics, Physics and Chemistry at GCE 'A' Level or equivalent will spend a minimum of four academic sessions provided that they satisfy all the other University requirements.

19.3 Admission and Graduation Requirements

19.3.1 Admission Requirements

Candidates are admitted into the degree programme in either of the following two ways:

1. Unified Tertiary Matriculation Examination (UTME) Mode (5 Year Degree Programme)

2. Direct Entry (DE) Mode (4 Year Degree Programme)

19.3.2 Unified Tertiary Matriculation Examination (UTME) Mode

For the five-year degree propgramme, in addition to acceptable passes in the Unified Tertiary Matriculation Examination (UTME), the minimum admission requirement is credit level passes in Senior School Certificate (SSC) in at least five subjects, which must include English Language, Mathematics, Physics, Chemistry and other acceptable science subjects at not more than two sittings.

19.3.3 Direct Entry (DE) Mode

For four-year Direct Entry, in addition to five (5) Senior School Certificate (SSC) credit passes which must include English Language, Mathematics, Physics and Chemistry, candidates with at least two passes in relevant subjects (Mathematics, Physics and Chemistry) at the GCE Advanced Level or IJMB or JUPEB may be considered for admission. Candidates who have good National Diploma (ND) result in relevant Engineering Technology programmes may also be considered for admission into 200 level. Holders of upper credit pass and above at Higher National Diploma (HND) level, are eligible for consideration for admission into 300 level.

19.4 GRADUATION REQUIREMENTS

The following regulations shall govern the conditions for the award of a honours degree in Engineering and Technology:

1. Candidates admitted through the UTME mode shall have registered for a minimum of 150 and maximum of 180 units of courses during the 5–year engineering degree

20.0 INTER-DISCIPLINARY TRANSFER (CHANGE OF DEGREE PROGRAM)

A student may be allowed to change his/her degree programme after completing the first or second academic year in the university. The change may prolong the time the student will stay in the university.

Procedure

a) The student applying for the inter-disciplinary transfer shall have made a minimum cumulative grade point of 3.00 on a five-point scale.
b) The student must possess at the time of entry to the university the entry requirements of the new programme to which he/she wishes to transfer
c) Inter-disciplinary transfer application forms which the student must complete are obtainable from the office of the registrar on presentation of the receipt for payment of the stipulated fee.
d) The registrar shall send the completed application forms to the relevant faculty/Department for recommendation.
e) Normally, not more than 10% of the number of the students admitted into a discipline for any one year shall be allowed to change their degree programmes.
f) Successful applicants shall be credited with those courses, including General Studies courses, taken in their former disciplines which are relevant to the new disciplines.

g) The receiving HoD shall have the responsibility of deciding on the relevance or otherwise of the courses taken in a student's previous discipline.
h) The registrar shall inform the applicants in writing of the results of their application.
i) The option to transfer can only be exercised once, and is without prejudice to the length of time required for graduation in the department concerned/
j) The completed application form with respect to inter-University Transfer shall submitted to the office of the Registrar for collation and presentation to the receiving Dean, and then to the HoD, who shall make recommendation and send back to the registrar through the Dean for appropriate action.

21.0 INTER-UNIVERSITY TRANSFER

a) Transfer students must come from universities recognized by UAES and shall spend a minimum three academic sessions before graduation.
b) Students seeking transfer to UAES must have met the minimum entry requirements as well as the special entry requirements of the departmrnt to which they want to transfer
c) To be eligible for transfer, a student shall have achieved a minimum cumulative grade point average of 3.00 on a five point scale.
d) In determining the final grade point average for the graduation of a transferred student, account shall be taken of the courses offered at both UAES and the student's former University.
e) In all cases no transfer shall be allowed into the 100-level.

Procedure

a) Students wishing to transfer to UAES must complete the application the application form for transfer obtainable from the Registry on payment of the stipulated fee into a designated University Account with receipt daily issued by the Bursary Department.
b) The completed application forms with respect to inter-university shall be submitted to the office of the Registrar for collation and presentation to the receiving Dean, then to the HoD, who shall make a recommendation and send back to the Registrar through the Dean for appropriate action.
c) The registrar shall inform candidates of the results of their application for transfer.
d) Normally, the number of students offered admission by transfer shall not exceed 10% of the discipline/s total admission in any one year.
e) A transfer student shall register for and be examined in, or otherwise make up for, all and compulsory courses which he or she did not take or pass in his/her former University.

22.0 REGISTRATION AND MATRICULATION

22.1 Registration period

a) Normal registration of courses for both the first and second semester shall be at the beginning of the first semester of the academic session, and shall last for two weeks from the date the exercise begins/

22.2 Late registration

a) Students may be given permission for late registration upon payment of the stipulated late registration fee. Late registration shall not last beyond 2 weeks from the expiration of the official registration period.
b) At the expiration of the extra 2 weeks of late register shall lose that session.

22.3 Registrable courses, coding and numbering

a) Depending on the Department, a student shall take the following categories of courses: core courses, required courses, General Studies courses and electives/
b) Each course is designated by a 3-letter code e.g., ''GST'' for General Studies and "FRN" for French/
c) Course numbering is according to the level of course and each course is represented with 3 digits, e.g., 101, 202, 301, 401 and 502 in a five-year programme. Odd numbers are first semester courses, while even numbers are second semester courses, but numbers with two zeros, e.g., 300, are those taken in between semesters or sessions.

22.4 Procedure for registration (Manual)

a) At confirmation of payment of school fees, the student is given the course registration form which is quadruplicate.
b) Registration commences firstly by paying all school fees.
c) The Academic Adviser guides the student in the registration of courses for the session
d) After the completion of the course registration, the course registration form must be approved and endorsed by the academic adviser and HoD respectively.
e) At the completion of course registration, the quadruplicate form is distributed as follows: (a) Registrar (b) Dean of faculty (c) HoD Academic Adviser.

Please Note: The Add and Drop form should likewise be in quadruplicate and distributed as recommended above.

22.5 Procedures for Online Registration

a) The registration commences with payment of fees by the student who is then given an access code for registration
b) The student then access the registration portal with the assigned code to register for the courses for the given session
c) The portal limits the students on the courses registrable
d) The portal also closes at the expiration of deadline for registration
e) The registration portal opens again for late registration at a specified fee
f) The student is assigned an access code on the payment of late registration fee.
g) Portal for registration closes again after the expiration of the deadline for late registration.

22.6 Matriculation

Matriculation is to formally admit the student into the University and it is only for students who have obtained their matriculation numbers and such a student must have paid all the necessary fees to the University, Faculty and the Department. At the

matriculation arena, the student swears to the University Oath of Allegiance and made to sign the matriculation register.

23.0 ADDING AND DROPPING OF COURSES

A student who wishes to add or drop a course(s) shall do so not later than four weeks from the date of registration.

i. A student may use Add and Drop form duly completed to effect the amendment in his/her registration course form on payment of prescribed fee each Add and Drop form used.
ii. A student shall first register the courses he/she failed during the previous session before registering courses for the current session.

24.0 DURATION OF ACADEMIC YEAR

The minimum duration of Engineering and Technology programs is five academic sessions for candidates who enter with Senior Secondary School Certificate or GCE 'O' Level qualifications. Candidates with relevant passes in Mathematics, Physics and Chemistry at GCE 'A' Level or equivalent will spend a minimum of four academic sessions provided that they satisfy all the other University requirements.

25.0 CLASS PERIOD AND ATTENDANCE

There is always a time – table that indicates period for each of the courses. While each lecture is expected to commence as scheduled and end 10 minutes before end of the scheduled period, seminars, tutorials, practical and workshops shall continue as long as scheduled.

Attendance to lectures, laboratories, workshop and tutorials is mandatory. Only a student who has been properly registered for a course and whose name appears on the official class list for that course shall be allowed into a class. A student who absents from prescribed course lecture for more than three weeks during any one semester without permission of the Senate or the Vice – Chancellor acting on behalf of the Senate, that semester may not be included as part of the scheme or study which the student is required to complete.

26.0 WITHDRAWAL AND RE-ADMISSION

26.1 Voluntary Withdrawal

Student who wishes to withdraw from the University shall write to the Registrar through the Dean of the Faculty and Head of his/her Department, seeking for approval of the Senate and upon approval, such withdrawal shall not exceed one academic year. Below are further guidelines regarding withdrawal from the University:

i. For fresh students, the written notice of withdrawal shall be given not later than two weeks after matriculation. For old students, the notice shall be given not later than four weeks after the beginning of the semester.
ii. Any student withdrawing from the University shall be required to complete a form giving a brief statement of the reason(s) and the effective date of leaving. The form shall be obtained from the Registrar.
iii. The student may retain grades carried for the semester examinations preceding the date of voluntary withdrawal.

iv. For such a student to be re-admitted into the University, he/she is to write a formal application to the Registrar through his/her Head of Department and Dean of Faculty and has to receive official clearance from the Registrar.

v. It is the responsibility of the Senate to prescribe conditions such a student must fulfil before he/she resumes the program after the period of withdrawal.

26.2 Unauthorized Withdrawal

A student who withdraws from the University without approval of the Senate for one academic year, may not be considered for re-admission until his/her case has been considered on its merit by the Departmental/Faculty Board and approved by the University's Senate.

26.3 Withdrawal for Academic Reasons

It is expected that every student admitted into the University maintains acceptable academic standards. Every student is also expected to maintain a minimum Grade Point Average for his/her year of study. The University through the Registrar shall send a letter of warning to any student who obtains a Cumulative Grade Point Average (CGPA) of 1.00 and a withdrawal letter shall be given to any student with a Cumulative Grade Point Average (CGPA) of less than 1.00.

26.4 Withdrawal for Health Reasons

A student may withdraw or be asked to withdraw on reasons of ill health but has to be certified by the Director of Health Services of the University. Such a student shall be readmitted into the University on once he/she produces a valid medical report from an approved Medical Officer and to be certified by the Director of Health Services.

26.5 Withdrawal based on Disciplinary Action

A student who is suspended on disciplinary grounds, may not be re-admitted unless with the consideration and approval of the Senate.

26.6 Financial Obligation after Withdrawal

Student who withdraws from the University for any reason whatsoever shall be required to clear any outstanding debts before he/she may be considered for readmission.

26.7 Time Limit for Re –Admission

A student who withdraws from the University for any reason and who is not re-admitted within a period of three (3) consecutive academic sessions from the date of his/her withdrawal, may not be credited with course(s) taken prior to withdrawal should he/she return to the University. The Head of Department may however make a general assessment of the student's knowledge of the course(s) taken prior to withdrawal and recommend the year of entry on readmission.

27.0 LECTURES AND EXAMINATION TIME TABLE COMMITTEEE

There shall be appointed by the Senate in every academic session a University Time Table Committee (UTTC) whose responsibility is to:

(a) Coordinate lecture and Examination Time Table for each semester.

(b) Rationalize available spaces to accommodate lectures and examinations with particular

attention to courses which cut across several Faculties.

(c) Resolve Time Table related and incidental issues in the University.

27.1 Membership of the Lectures and Examination Time Table Committee

The membership of the University Lectures and Examination Time Table Committee shall be drawn from the Chairmen of all the Faculty Time Table Committees with the Senate appointed Chairman.

28.0 EXTERNAL AND INTERNAL EXAMINATION

28.1 Appointment of External Examiners

The Department in agreement with the University laid down rules for appointment of an external examiner nominates an external examiner who shall be appointed by the Senate.

28.2 Functions of External Examiner

i. The External Examiner shall moderate all final year or professional examination question papers before the examination and shall send any comment on them to the Head of Department.

ii. The External Examiner shall mark or re –mark all such portions of candidate's scripts as he/she deems fit.

iii. The External Examiner shall participate in the determination of the results of all final year students.

iv. The External Examiner shall be required to submit to the Vice Chancellor a report on the result of the examination together with general comments on the work of the Department.

v. A person appointed as an External Examiner shall satisfy the following four conditions:

a. Must be external to the University

b. Must have had adequate experience in the University Academic work.

c. Must have high academic standing.

d. Must be fit to sign all Degree results before they are presented to the Faculty Board.

29.0 EXAMINATION MISCONDUCT AND DISCIPLINARY MEASURES

29.1 Examination Misconduct/ Offences

Examination misconduct is any one of a range of unfair practices or infringement of UAES examination regulations before, during and / or after conduct of an examination. These include but are not limited to:

i. Impersonation
ii. Students copying each other

iii. Students bringing in into the examination hall papers, mobile phones/phone hearing/ communication accessories, other materials (including programmable electronics or calculators, except where specifically required for the course) relevant in whatever form to the examinations
iv. All forms of communication between students during an examination
v. Causing any form of disturbance
vi. Not obeying the invigilators
vii. An undue influence on or unlawful contact with examiners and other staff
viii. As well as aiding and abetting by non-UAES students and personnel.

29.2 Disciplinary Measures

The disciplinary measures prescribed for suspects involved in examination misconduct in UAES as approved by UAES senate are stated on the table below

S/N	NATURE OF OFFENCE	PRESCRIBED PUNISHMENT
1	Possession of a mobile phone, Smart phone or other electronic devices inside the examination hall.	Rustication for one (1) academic session
2	Second offender for all misconduct cases.	Expulsion.
3	Impersonation during examination	Rustication for two (2) sessions
4	Fighting Examination Supervisor(s), invigilators(s), etc.	Expulsion.
5	Breaking in and unofficially obtaining question papers	Expulsion.
6	Exchange of Answer booklets	Rustication for one (1) academic session
7	Exchange of materials inside examination hall.	Rustication for one (1) academic session
8	Collaborative copying	Rustication for one (1) academic session.
9	Smuggling of question paper or examination material in or out of the examination hall.	Rustication for two (2) academic sessions.
10	Refusal to appear before a panel.	Rustication for one (1) academic session in the first instance.
11	Forging/altering result grades and signature of officials	Expulsion.
12	Coming into the hall with a gun or any other dangerous weapon.	Expulsion
13	Threatening a staff or members of their families verbally or in writing	Rustication for two (2) academic sessions.
14	Procuring and altering a medical certificate in order to obtain a deferment of examination	Rustication for one (1) academic session
15	Sorting/alteration of examination grades by whatever means (eg. writing of examinations outside the examination venue, etc	Expulsion.
16	Submission of forged registration materials (credentials, results, affidavits, etc).	Expulsion
17	Plagiarism (assignments, projects, thesis).	As approved by Senate
18	Destruction/obstruction of examination misconduct evidence (eg..running away with answer booklet chewing incriminating materials, etc).	Rustication for two (2) academic sessions. ,

29.3 Absence from Examination

i. Candidate must present themselves for such University examination in courses which they have registered. Under these regulations, candidates who fail to do so for reasons other than illness or accident shall be deemed to have failed the examination.

ii. Misreading of the examination time table shall not be accepted as a satisfactory explanation for absence.

iii. Whenever a student is prevented by ill health from taking an examination, the candidate shall notify the Registrar through an application in writing through the Head of Department and the Dean of the Faculty, and shall submit a medical certificate issued or validated by the Director of Health Services of the University within one month of the examination.

iv. Such an application shall be processed to the Senate through the relevant Department Board of studies and School Board of Studies. Where successful, the Senate may approve that the student takes the examination at the next available opportunity as a first attempt.

29.3 Internal Examination

i. Each lecturer shall be required to submit his/her questions as directed by the Departmental Board of Examiners, for the proposed examination for each course taught, through the Head of Department.

ii. Question papers for the first and second semester examinations in final year courses shall be submitted to the External Examiner for moderation.

29.4 Examination Ethics

The Department of Mechanical Engineering deems it fit to always enforce strict examination ethics during quiz and examinations, as enshrined in the University student's hand book. Every student of the department is expected to refrain from committing any examination misconduct. The following actions are examination considered as misconduct by the University:

i. Use of any material like book, printed – paper etc meant to help the student in the examination hall.
ii. Giving any kind of assistance during an examination.
iii. Refusing to stop writing at the end of an examination.
iv. Refusing to surrender any suspected incriminating material.
v. Impersonation
vi. Being caught with leaked examination questions.
vii. Leaving the examination hall with the hope of coming back into the hall without permission from the invigilator(s).
viii. Speaking to another student during the course of an examination.
ix. Smoking or making noise during the course of examination.
x. Committing any other offence not specified here but which are connected with examination in the University.
xi. The punishment or penalty meted for the various offences vary but ranges from instant expulsion, rustication from the University for some years. All students are

encouraged and advised to refrain from examination malpractices in the University.

30.0 EXPULSION FROM THE UNIVERSITY

a) Studentship may be terminated at any point through expulsion from the University on grounds of gross misconduct or intellectual inability to benefit from the academic programmes offered by the University
b) An expelled student shall not be readmitted.
c) Review of Scripts of aggrieved candidates
d) A student aggrieved by his grading may in the first instance, petition the registrar through the HoD and Dean for a review of his/her script after payment of a Senate stipulated fee, stating in detail the ground (s) for the application within one week of the release of the result. The candidate shall specifically reject the published result. The registrar shall refer the petition to the College / Faculty Board through the Provost / Dean.
e) On receipt of the petition, the Provost / Dean shall convene a meeting of the collage / Faculty Board to consider the petition. If the board is satisfied that a *prima facia* case has been made, permission is sought from the Senate for the script to be reviewed, thereafter, the Provost/Dean sets up a Review Panel comprising two internal examiners not involved in the earlier marking scheme, and report to the provost/Dean. If the course is a final year second semester course, the result of the review is sent to Senate for final determination along with the original score and the recommendation of the college / faculty Board. If the college / Faculty Board decide that a prima facie case has not been made, it shall write in detail the reason (s) for its decision and convey same to Senate through the Vice-Chancellor for disposal action.
f) Where it is established that a student was failed because of a relationship with the lecturer involving such thing as sexual harassment, intimidation, etc. the lecturer shall face appropriate disciplinary action.
a) Where a student is established to have made false claim against a lecturer, he/she shall face disciplinary action for exam misconduct and damage of character.

31.0 REVIEW OF SCRIPTS OF AGGRIEVED CANDIDATE

i. A student aggrieved about his/her grading shall in the first instance, petition the Registrar through the Head of Department. The Registrar shall refer the petition to the Faculty Board through the Dean of the Faculty for a review of student's answer script.

ii. For examinations in final year courses, the recommendation of the Faculty Board shall be sent to Senate through the Senate Committee on Examination for ratification.

iii. A student applying for review shall be required to pay the prescribed fees.

iv. Photocopies of the scripts to be reviewed, with all comments of the original marker removed, shall be forwarded for review such that:

a. Non – final year courses to be assigned to two internal examiners. In both cases, the reviewers shall not have participated in the original marking of the scripts.

v. Time limit for the submission of petition for review of scripts by the aggrieved student shall be as follows:

a. Final year courses: Two months from the date the results are officially published by the Registrar's Office.
b. For Non – Final year courses: Two months from the date the results (date stamped) are published in the Department.
c. The grade awarded in the review exercise shall supersede the earlier grade.

vi Where it is established that a student was failed because of a relationship with the lecturer involving such thing as sexual harassment, intimidation, etc. the lecturer shall face appropriate disciplinary action.

vii Where a student is established to have made false claim against a lecturer, he/she shall face disciplinary action for exam misconduct and damage of character.

32.0 DETERMINATION OF RESULT

32.1 Course Credit Unit System

This should be understood to mean a 'quantitative system of organization of the curriculum in which subject areas are broken down into unit courses which are examinable and for which students earn credit(s) if passed'. The courses are arranged in progressive order of difficulty or in levels of academic progress, e.g. Level I or year 1 courses are 100, 101 etc. and Level II or Year II courses are 200, 202 etc. The second aspect of the system is that courses are assigned weights allied Credit Units

32.2 Grading System

The mark obtained in each course is made up of continuous assessment of 30% and the end of semester examination of 70% in courses without practical/laboratory components. While the grading of courses with practical/laboratory components examination shall be 60%, continuous assessment of 20% and practical/laboratory shall be 20%. Each course shall be graded over 100% (marks).

32.3 scores and Performance Rating

i. A candidate's raw scores in the examinations are usually expressed as percentage and converted into grades which are weighted by being assigned points values. The following ranges of marks and their corresponding grades and points weighting are used.
ii. All degree courses (required, restricted elective, unrestricted elective and general studies) undertaken by the student as well as the successful completion of Industrial attachment, shall count toward the evaluation of his/her degree.

iii. Course Grading System

Table 32a: Grading System

Marks (%)	Letter Grade	Performance Rating	Grade Points (GP)
70 – 100	A	Distinction	5.00
60 – 69	B	Very Good	4.00

50 – 59	C	Good	3.00
45 – 49	D	Fairly Good	2.00
40 -44	E	Pass	1.00
0 – 39	F	Fail	0.00

iv. The mark scored in each course (continuous assessment score plus the end of semester examination score) has an equivalent letter grade of A, B, C, D & F. Grades A to E are pass grades while F is failure grade. It is the responsibility of the Departmental/Faculty Board to determine how each Lecturer within the school arrives at the grades.

32.4 Grade Point Average (GPA)

Performance in any semester is reported in Grade Point Average. This is the average of weighted grade points earned in the courses taken during the semester. The Grade Point Average is obtained by multiplying the Grade Point in each course by the number of Credit Units assigned to that course, and then summing these up and dividing by the total number of Credit Units taken for the semester. See details below:

i. The academic performance of a student in any semester shall be measured with the Grade Point Average (GPA). The maximum value is 5.00 and the minimum is 0.00.

ii. Quality Point (QP), the product of the credit unit and grade point of each course defines the Quality Point for that course.

iii. Grade Point Average (GPA) – sum of Quality Point divided by Total Credit units for all the courses registered in the semester.

iv. To compute the Grade Point Average (GPA) for a student, the total aggregate of the Grade Points is divided by the number of semester units. A Grade Point is obtained by multiplying the point score in each course by the number of semester units assigned to that course.

Table 32b: Grading System (First Semester)

Course Code	Course Title	Student Score (%)	Course Credit Unit (CU)	Letter Grade	Grade Point	Quality Point (QP)
MTH 101	Elementary Mathematics I	70	3	A	5.00	5.00*3 = 15
GST 101	Communication in English I	60	2	B	4.00	4.00*2=8
CSC 101	Introduction to Computer	50	3	C	3.00	3.00*3 = 9
PHY 101	General Physics I	30	3	F	0.00	0.00*3= 0
			11			**32**

Calculation of Grade Point Average (GPA) for the semester is done by:

= TQP divided by TCU

= 15+8+9+3+2+3+2

=32/11 = 2.91

Table 32c: Grading System (Second Semester)

Course Code	Course Title	Student Score (%)	Course Credit Unit (CU)	Letter Grade	Grade Point	Quality Point (QP)
MTH 102	Elementary	70	3	A	5.00	5.00*3 = 15
GST 102	Communication in	60	2	B	4.00	4.00*2=8
CHM 102	General Chemistry	50	3	C	3.00	3.00*3 = 9
PHY 102	General Physics II	40	3	F	0.00	0.00*3= 0
			11			**32**

GPA = 32/11 = 2.91

32.5 Computation of Cumulative Grade Points Average (CGPA)

The Computation of Cumulative Grade Points Average (CGPA) is the up-to-date mean of the Grade Points earned by the student in a program of study. To compute the Cumulative Grade Point Average, the total of Grade Points multiplied by the respective Credit Units for all the semesters are added and then divided by the total number of Credit Units for all courses registered by the student. It is an indication of the student's overall performance at any point in the training program. See details below:

i. The Cumulative Grade Point Average (CGPA) is the measure of the student's overall academic performance at any given period in the program.
ii. All courses taken by a student are used in the computation of his Cumulative Grade Point Average (CGPA).
iii. Cumulative Grade Point Average is normally computed at the end of each session as an up –to date weighted mean of the grade points, where the weights are the course credit units.
iv. The Grade Point earned at the end of all semester examinations shall count towards the CGPA (Cumulative Grade Point Average). Cumulative Grade Point Average (CGPA) is the sum of all Quality Points divided by sum of all credit units for all courses registered/repeated so far in the student's academic program.
CGPA for First and Second Semester (Tables 32b and 32c) = 32+32/ 10 +10 = 64/20 = 3.20
v. The Final Cumulative Grade Point Average (FCGPA) calculated at the end of a student's academic program, shall determine the class of degree he/she shall be awarded.

32.6 Classification System of Degree

The class of degree shall be determined as follows (Table 32d):

Table 32d: Class of degree and Cumulative Grade Point Average

Class of Degree	**Cumulative Grade Point Average**
1st Class Honours	4.50 – 5.00
2nd Class Honours (Upper Division)	3.50 – 4.49
2nd Class Honours (Lower Division)	2.40 – 3.49
3rd Class Honours	1.50 – 2.39
Pass	1.00 – 1.49
Fail	0.00 – 0.99

33.0 TRANSCRIPT

i. A student may apply to the Registrar for a transcript of his/her academic records on the payment of stipulated fees.

ii. An expelled student shall have the reason for expulsion stated in his/her transcript.

iii. Transcript shall be sent only to organization and Institutions at request of the student concerned. However, transcript clearly marked "STUDENT'S COPY" may be issued to student on request.

34.0 INDEBTEDNESS TO THE UNIVERSITY

(i) The use of the University facilities may be withdrawn from any student who owes the University, or who fails to return any University property in his/her possession. Facilities include all forms of academic instruction and supervision, the ID card, the library, and laboratories as well as residential accommodation owned and administered by the University.

(ii) Except with permission of the Senate, no student who is indebted to the University may register for a further period of study in the University.

(iii) Any student indebted to the University will not be issued with a final statement of result unless the debt are completely paid and requisite clearance obtained from the Bursary and other relevant departments.

35. 0 ACADEMIC ADVISING

35.1 General Administrative Issues

i. As many academic staff as possible shall be involved in academic advising. Due allowances shall be made for time spent by staff members concerned with academic advising in relation to their teaching and other duties

ii. The department is also saddled with the responsibility of counselling the students. Each of the levels will have Class advisers who are appointed by the Head of the Department. Each student is advised and encouraged to reach the class adviser first on any issue (s) bordering such a student.

- Individual freshmen are assigned to academic advisers and stay with them till graduation;
- Students are assigned to academic advisers by session and level; or
- Student are assigned academic advisers by discipline and stay with them till graduation.

iii. Materials to be used in academic advising include the following:

(a) Materials to be produced by the Registrar:
- Freshmen's Guide: This will be distributed to both students and staff.
- University Academic Regulations.

(b) Forms for general or Particular use:

- **Adviser's Check sheet:** This is to be used in Departments for keeping track of each students' academic progress.
- **Departmental Enrollment sheet:** This is a standardized Departmental enrollment sheet containing the names and signatures of all the students registering and the names and signature of the Academic Advisers. The sheet is to be completed and signed by the Adviser during or after course registrations. Each Department shall prepare its own enrollment sheet and use it every year.

(c) Information to be prepared in and used by the Department:

- A list of Advisers and their Advisees.
- The curricular for academic programs within the Department.
- Composites of all examination results.

35.2 Function of Various Officers in Academic Advising

(i) Academic Advisers

(a) Directing students on appropriate courses to register for.
(b) Ensuring effective enrollment of students during registration period.
(c) Checking of academic load of students with regard to the number of credit units to be carried per semester and per session.
(d) Changing of courses or degree programmes.
(e) Making sure that the regulations of the Department/Faculty/College and the University are duly observed by the students.
(f) Careful maintenance of student folders or files.
(g) Keeping regular office hours for the students.
(h) Being available for consultation by students.
(i) Making a sessional academic appraisal of the work of each advisee.
(j) Consulting the HOD, Dean of Faculty, and Dean of Student Affairs Office when students have problems which are seriously affecting their academic work.

(ii) Heads of Departments

(a) Appointment of Advisers.
(b) Ensuring that Advisers do their work effectively.
(c) Meeting with students and staff in order to explain Departmental procedures, especially before registration courses.

(d) Receiving Advisers' recommendations and suggestions and considering special cases referred to them by Advisers. The types of recommendations to be checked include programmes for individual students, credit loads, and changes of subject or degree programmes.

(e) Ensuring compliance with all University **regulations.**

(f) Mapping out in detail all degree programmes and course requirements in the Department.

(g) Maintaining the major files on the students and giving their staff access to such files and students' academic records.

(h) Making inter-departmental arrangements which concern staff and students in their Departments.

(i) Keeping the Dean and the Registrar informed about allocation of Academic Advisers and of teaching responsibilities.

(j) Ensuring that from time to time student's progress and academic advising are discussed in Departmental Board meetings.

(iii) **Deans of Faculty**

(a) Ensuring that all Departments have clearly mapped out programmes.

(b) Reviewing HODs' recommendations and suggestions and considering special cases. Such special cases shall deal with mapping out programmes for individual students, checking on credit course loads, and changing of courses or degree programmes.

(c) Enforcing academic regulations.

(d) Ensuring a conducive teaching and learning environment within the Faculty.

(iv) **Registrar**

(a) Making available to the Faculties and Departments all academic and other University regulations.

(b) Providing adequate, effective and timely information to students after their applications are accepted and they have been admitted.

(c) Ensuring that lists of all matriculated students are forwarded to the Faculties and Departments within one week of matriculation.

(d) Addressing the students during orientation, giving them as much information as possible on academic life.

(e) Disseminating information about job opportunities for students.

(f) Providing information to students about careers and financial assistance.

(v) **Dean of Student Affairs**

(a) Advising students on careers.

(b) Arranging vacation jobs for students, where possible.

(c) Assisting in making residence arrangements and initiating disciplinary action.

(d) Informing HODs of (b) and (c) above.

(e) Giving necessary psychological advice.

(f) Ensuring that students are properly mobilized for the NYSC programme.

35.3 Student's Welfare

35.3.1 Handling of Academic Grievances and any other Student's Complaints

Immediate attention is given to every complaint made by students. All academic grievances and any other student's complaints are documented and handed over to the appropriate committee through the Head of the Department for departmental matters and through the Dean of Faculty when it has to with omitted results, errors in computation of CGPA, correction of wrong grades etc. However, the students also have the right to petition the

school Board or Senate when they feel they are not served justice with the decision of the departmental or Faculty Board.

35.3.2 Duration of Classes, Class attendance and absence from Class

There is always a time – table that indicates period for each of the courses. While each lecture is expected to commence as scheduled and end 10 minutes before end of the scheduled period, seminars, tutorials, practical and workshops shall continue as long as scheduled.

Attendance to lectures, laboratories, workshop and tutorials is mandatory. Only a student who has been properly registered for a course and whose name appears on the official class list for that course shall be allowed into a class. A student who absents from prescribed course lecture for more than three weeks during any one semester without permission of the Senate or the Vice – Chancellor acting on behalf of the Senate, that semester may not be included as part of the scheme or study which the student is required to complete

35.3.3 Departmental Examination Board

Departmental Board of Examiners comprises:

i. The Head of Department
ii. Not less than 2 and more than 6 others comprising the most senior academic members of the Department representing the specialties in the Department.
iii. The Departmental Examination Officer shall be a member/secretary.

35.3.4 Functions of Departmental Examination Board

i. To moderate all question papers of the Department

ii. To approve the Departmental examination results with the course lecturers in attendance

iii. To advise the Head of Department on the appointment of External examiners.

iv. To undertake such other matters as may be referred to it by the Head of Department in accordance with the University standard.

35.3.5 Appointment of External Examiners

The Department in agreement with the University laid down rules for appointment of an external examiner nominates an external examiner who shall be appointed by the Senate.

35.4 PROFESSIONAL ASSOCIATIONS

The following Professional Associations exist for students in the department to belong, where they are kept abreast of happenings in the Profession at seminars, conferences, workshops etc:

a. Nigerian Institution of Mechanical Engineers (NIMechE), UAES Chapter
ii. Society of Mechanical Engineering Students (SOMES), UAES Chapter

35.5 SECRET CULT AND ITS ACTIVITIES

Secret cult associations and activities are banned by the University. Any student found belonging to any secret society will be expelled from the University.

35.6 FORMAT FOR RESEARCH THESIS

The Preliminary Pages are to be arranged in this order:

(i) Title

(ii) Certification

(iii) Dedication

(iv) Acknowledgment

(v) Abstract

(vi) Contents

(vii) List of Tables

(viii) List of Figures/Charts

- ✓ **1.0. Introduction - Chapter 1**

This consists of:

(i) Background Information

(ii) Problem Statement

(iii) Objectives

(iv) Justification of Study

(v) Scope of Study

- ✓ **2.0 Literature Review - Chapter 2**
- ✓ **3.0 Methodology or Materials and Methods – Chapter 3**

This comprises of materials, apparatus, the description of the study area, sample, design, procedure for data collection and analysis.

- ✓ **4.0 Results and Discussion - Chapter 4**
- ✓ **5.0 Conclusion and Recommendations - Chapter 5**
- ✓ **References** (Harvard or APA Style)
- ✓ **Appendices** (if any)

35.7 FORMAT FOR UNDERGRADUATE SEMINAR PREPARATION AND PRESENTATION

The seminar report shall follow the same format as the research report. Emphasis will be placed on the presentation of the seminar report by the student and so each student is expected understand his/her work as the grading will be made on:

* Composure
* Technical
* Content of presentation
* Ability to answer question
* Use of visual aids

35.8 SIWES RATING AND ASSESSMENT

In engineering education, industrial attachment is very crucial. The minimum duration of this attachment should be 34 weeks (one semester and 2 long vacations) and should be broken into the following modules: Students Work Experience Program (10 weeks – long vacation); Students Industrial Work Experience Scheme (24 weeks, one semester plus long vacation).

To make the training effective, it is important that the students learn how to operate some of the ordinary machines and tools they will encounter in the industry before they go for the attachment. Therefore they should start with Student Work Experience Program, which is

conducted in the Faculty Workshops, under strict industrial conditions. On successful completion of Students Work Experience Program, the Students Industrial Work Experience Schemes can be done in industries under strict industrial conditions and supervision.

Normally, industrial attachment should be graded and no student should graduate without passing all the modules of the attachment and this should be used in degree classification.

There should be a Faculty Industrial Training Unit with full complement of staff and facilities to function.

35.9 DEFINITION OF STANDARD COURSE TERMINOLOGIES

i. **Core/Compulsory Course:** A course which every student must compulsorily take and pass in any particular program at a particular level of study.

ii. **Required Course:** A course that you take at a level of study and must be passed before graduation.

iii. **Elective Course:** A course that students take within or outside the faculty. Students may graduate without passing the course provided the minimum credit unit for the course had been attained.

iv. **Optional Course:** A course which students can take based on interest and may count towards the minimum credit unit required for graduation.

v. **Pre-requisite Course:** A course which student must take and pass before taking a particular course at a higher level.

vi. **Con-current Courses:** These are specific courses or group of courses which must be taken within the same semester.

35.10 MINIMUM AND MAXIMUM CREDIT LOAD PER SEMESTER

The Minimum credit load per semester is 15 course unit. While the maximum course unit per semester is 24.

36.0 GLOBAL COURSE STRUCTURE SEMESTER BY SEMESTER FOR ALL LEVELS OF STUDY.

Global Course Structure

Level	GST/ENT	Basic Science	Discipline GET	Programme (MEE)	SIWES	Total Units
100	4	18	3	1	-	26
200	4	-	26	-	3	33
300	4	-	15	0	4	23
400	-	-	-	2	8	10
500	-	-	5	8	-	13
Total	**12**	**18**	**49**	**11**	**15***	**105**

*All 15 SIWES units credited in the 2nd Semester of 400-Level

Institutional 30% CCMAS addition Course Structure

Level	UAES-AGR/ UAES-EMT	Basic Science/ UAES-STA	Discipline/ UAES-ENG	Programme /UAES-MEE	Total Units
100	5	7	1	-	13

200	2	-	3	4	9
300	-	-	3	11	14
400	-	-	-	14	14
500	-	-	-	17	17
Total	**7**	**7**	**7**	**46**	**67**

100 Level (First Semester Courses)

Course Code	Course Title	Units	Status	LH	PH
GST 111	Communication in English	2	C	15	45
GET 101	Engineer in Society	1	C	15	-
CHM 101	General Chemistry I	2	C	30	-
CHM 107	General Practical Chemistry I	1	C	-	45
MTH 101	Elementary Mathematics I	2	C	30	-
MTH 103	Elementary Mathematics III	2	C	30	-
PHY 101	General Physics I	2	C	30	-
PHY 103	General Physics III	2	C	30	-
PHY 107	General Practical Physics I	1	C	-	45
MEE 101	Introduction to Mechanical Engineering	1	C	15	-
UAES-AGR 101	Farm Practice I	1	C	-	45
UAES-LEP 105	Language Enhancement Programme I	1	C	15	0
UAES-ENG 101	Introduction to Engineering Workshop Practice	1	C	-	45
Total		**19**			

100 Level (Second Semester Courses)

Course Code	Course Title	Units	Status	LH	PH
GST 112	Nigerian Peoples and Culture	2	C	30	-
GET 102	Engineering Graphics and Solid Modelling I	2	C	15	45
CHM 102	General Chemistry II	2	C	30	-
CHM 108	General Practical Chemistry II	1	C	-	45
MTH 102	Elementary Mathematics II	2	C	30	-
PHY 108	General Practical Physics II	1	C	-	45
UAES-AGR 102	Farm Practice II	1	C	-	45
UAES-EMT 102	Environmental and Public Health	1	C	15	-
UAES-PHY 102	General Physics II	2	C	30	-
UAES-PHY 104	General Physics IV	2	C	30	-
UAES-STA 112	Probability I	3	C	45	-
UAES-LEP 108	Language Enhancement Programme II	1	C	15	0
Total		**20**			

200 Level (First Semester Course)

Course Code	Course Title	Units	Status	LH	PH

ENT 211	Entrepreneurship and Innovation	2	C	30	-
GET 201	Applied Electricity I	3	C	45	-
GET 205	Fundamentals of Fluid Mechanics	3	C	45	-
GET 209	Engineering Mathematics I	3	C	45	-
GET 211	Computing and Software Engineering	3	C	30	45
UAES-AGR 201	Farm Practice III	1	C	-	45
UAES-EMT 201	Occupational Safety	1	C	15	-
UAES-GET 207	Applied Mechanics	3	C	45	-
UAES-MEE 213	Metrology and Instrumentation	2	C	15	45
Total		**21**			

200 Level (Second Semester Courses)

Course Code	Course Title	Units	Status	LH	PH
GST 212	Philosophy, Logic and Human Existence	2	C	30	-
GET 202	Engineering Materials	3	C	45	-
GET 204	Students Workshop Practice	2	C	15	45
GET 206	Fundamentals of Thermodynamics	3	C	45	-
GET 208	Strength of Materials	3	C	45	-
GET 210	Engineering Mathematics II	3	C	45	-
UAES-MEE 212	Solar Energy Engineering	2	C	30	-
Total		**18**			

300 Level (First Semester Course)

Course Code	Course Title	Units	Status	LH	PH
GET 301	Engineering Mathematics III	3	C	45	-
GET 305	Engineering Statistics and Data Analytics.	3	C	45	-
GET 307	Introduction to Artificial Intelligence, Machine Learning and Convergent Technologies	3	C	45	-
UAES-GET 311	Engineering Economics	3	C	45	-
UAES-MEE 307	Dynamic Systems and Vibration	3	C	30	45
UAES-MEE 309	Energy Management in Industry	2	E	30	-
UAES MEE 311	Reliability and Maintainability Engineering	3	C	45	-
Total		**18**			

300 Level (Second Semester Course)

Course Code	Course Title	Units	Status	LH	PH
GST 312	Peace and Conflict Resolution	2	C	30	-
ENT 312	Venture Creation	2	C	15	45

GET 302	Engineering Mathematics IV	3	E	45	-
GET 304	Technical Writing and Communication (including Seminar Presentation Skills)	3	C	45	-
GET 306	Renewable Energy Systems and Technology	3	C	30	45
MEE 306	Computer-Aided Design and Manufacture	1	E	-	45
UAES-MEE 314	Plasticity	2	C	30	-
UAES-MEE 308	Introduction to Automotive and Autotronics Engineering	3	C	30	45
UAES-MEE 310	Tribology-Mechanical Interface Design	2	E	30	-
Total		**15**			

400 Level (First Semester Course)

Course Code	Course Title	Units	Status	LH	PH
MEE 401	Mechanical (Machine) Engineering Design II	2	C	30	-
MEE 402	Theory (Mechanics) of Machines I	2	C	30	-
MEE 403	Applied (Engineering) Thermodynamics I	2	E	30	-
MEE 404	Applied Fluid Mechanics	2	E	30	-
MEE 405	Heat and Mass Transfer	3	C	45	-
MEE 407	Advanced Mechanics of Materials	2	E	30	-
UAES-MEE 406	Introduction to Mechatronics	3	C	30	45
UAES-MEE 407	Fracture of Structural Materials	3	E	45	-
UAES-MEE 408	Theory of Elasticity	3	C	30	45
UAES-MEE 409	Fluid Dynamics	3	C	45	-
Total		**16**			

400 Level (Second Semester Course)
SIWES Courses

Course Code	Course Title	Units	Status	LH/ PH
GET 299	SIWES I: SWEP	3	C	9 weeks
GET 399	SIWES II	4	C	12 weeks
GET 499	SIWES III	8	C	24 weeks
Total		**15***		

*** All** SIWES **courses are credited in the 2nd Semester of 400-level**

500 Level (First Semester Course)

Course Code	Course Title	Units	Status	LH	PH
GET 501	Engineering (Project) Management	3	C	45	-
MEE 501	Applied Design	2	C	15	45
MEE 590	B.Eng. Project	6	C	-	270
UAES-MEE 513	Manufacturing Technology	2	C	30	-
UAES-MEE 515	Engineering Design Process	2	C	30	-
Total		**15**			

500 Level (Second Semester Course)

Course Code	Course Title	Units	Status	LH	PH
GET 502	Engineering Law	2	C	30	-
UAES-MEE 504	Control Systems	3	C	45	-
UAES-MEE 512	Turbomachinery	3	C	30	-
UAES-MEE 515	Engineering Design Process	2	C	30	-
UAES-MEE 516	Machine Design	3	C	45	-
UAES-MEE 503	Cost Engineering	2	C	30	-
Total		**15**			

37.0; 38.0; & 39.0: **COURSE OBJECTIVES FOR ALL THE COURSES STATED, LEARNING OUTCOMES FOR ALL THE COURSES STATED, AND COURSE CONTENTS FOR ALL THE COURSES STATED**

COURSE CONTENTS AND LEARNING OUTCOMES

100 LEVEL (FIRST SEMESTER COURSE)

GST 111: Communication in English (2 Units C: LH 15; PH 45)

Learning Outcomes

At the end of this course, students should be able to:

1. identify possible sound patterns in English Language;
2. list notable language skills;
3. classify word formation processes;
4. construct simple and fairly complex sentences in English;
5. apply logical and critical reasoning skills for meaningful presentations;
6. demonstrate an appreciable level of the art of public speaking and listening; and
7. write simple and technical reports.

Course Contents

Sounds and sound patterns in English Language (vowels and consonants, phonetics and phonology); English word classes (lexical and grammatical words, definitions, forms,

functions, usages, collocations); major word formation processes; the sentence in English (types: structural and functional); grammar and usage (tense, concord and modality). Reading and types of reading, comprehension skills, 3RsQ. Logical and critical thinking; reasoning methods (logic and syllogism, inductive and deductive argument, analogy, generalisation and explanations). Ethical considerations, copyright rules and infringements. Writing activities (pre-writing (brainstorming and outlining), writing (paragraphing, punctuation and expression), post-writing (editing and proofreading). Types of writing (summary, essays, letter, curriculum vitae, report writing, note-making). etc. Mechanics of writing. Information and Communication Technology in modern language learning. Language skills for effective communication. The art of public speaking.

GET 101: Engineer in Society (1 Unit C: LH 15)

Learning Outcomes

At the end of this course, the students should be able to:

1. differentiate between science, engineering and technology, and relate them to innovation;
2. distinguish between the different cadres of engineering – engineers, technologists, technicians and craftsmen and their respective roles and competencies;
3. identify and distinguish between the relevant professional bodies in engineering;
4. categorise the goals of global development or sustainable development goals (SDGs); and
5. identify and evaluate safety and risk in engineering practice.

Course Contents

History, evolution and philosophy of science. engineering and technology. The engineering profession – engineering family (engineers, technologists, technicians and craftsmen), professional bodies and societies. Engineers' code of conduct and ethics, and engineering literacy. Sustainable development goals (SDGs), innovation, infrastructures and nation building - economy, politics, business. Safety and risk analysis in engineering practice. Engineering competency skills – curriculum overview, technical, soft and digital skills. Guest seminars and invited lectures from different engineering professional associations.

CHM 101: General Chemistry I (2 Units C: LH 30)

Learning Outcomes

At the end of this course, the students should be able to:

1. define atom, molecules and chemical reactions;
2. discuss the modern electronic theory of atoms;
3. write electronic configurations of elements on the periodic table;
4. rationalise the trends of atomic radii, ionisation energies, electronegativity of the elements, based on their position in the periodic table;
5. identify and balance oxidation–reduction equation and solve redox titration problems;
6. draw shapes of simple molecules and hybridised orbitals;
7. identify the characteristics of acids, bases and salts, and solve problems based on their quantitative relationship;
8. apply the principles of equilibrium to aqueous systems using LeChatelier’s principle to predict the effect of concentration, pressure and temperature changes on equilibrium mixtures;
9. analyse and perform calculations with the thermodynamic functions, enthalpy, entropy and free energy; and
10. determine rates of reactions and its dependence on concentration, time and temperature.

Course Contents
Atoms, molecules, elements and compounds, and chemical reactions. Modern electronic theory of atoms. Electronic configuration, periodicity and building up of the periodic table. Hybridisation and shapes of simple molecules. Valence forces; Structure of solids. Chemical equations and stoichiometry; chemical bonding and intermolecular forces, kinetic theory of matter. Elementary thermochemistry; rates of reaction, equilibrium and thermodynamics. Acids, bases and salts. Properties of gases. Redox reactions and introduction to electrochemistry. Radioactivity.

CHM 107: General Practical Chemistry I (1 Unit C: PH 45)

Learning Outcomes
At the end of this course, the students should be able to:
1. state the general laboratory rules and safety procedures;
2. collect scientific data and correct carry out chemical experiments;
3. identify the basic glassware and equipment in the laboratory;
4. state the differences between primary and secondary standards;
5. perform redox titration;
6. record observations and measurements in the laboratory notebooks; and
7. analyse the data to arrive at scientific conclusions.

Course Contents
Laboratory experiments designed to reflect topics presented in courses CHM 101 and CHM 102. These include acid-base titrations, qualitative analysis, redox reactions, gravimetric analysis, data analysis and presentation.

MTH 101: Elementary Mathematics I (Algebra and Trigonometry) (2 Units C: LH 30)

Learning Outcomes
At the end of the course students should be able to:
1. define and explain set, subset, union, intersection, complements, and demonstrate the use of
   Venn diagrams;
2. solve quadratic equations;
3. solve trigonometric functions;
4. identify various types of numbers; and
5. solve some problems using binomial theorem.

Course Contents
Elementary set theory, subsets, union, intersection, complements, Venn diagrams. Real numbers, integers, rational and irrational numbers. Mathematical induction, real sequences and series, theory of quadratic equations, binomial theorem, complex numbers, algebra of complex numbers, the argand diagram. De-Moiré's theorem, nth roots of unity. Circular measure, trigonometric functions of angles of any magnitude, addition and factor formulae.

MTH 103: Elementary Mathematics III (Vectors, Geometry and Dynamics) (2 Units C: LH 30)
Learning Outcomes

At the end of the course, students should be able to:
1. solve some vectors in addition and multiplication;
2. calculate force and momentum; and
3. solve differentiation and integration of vectors.

Course Contents

(Pre-requisite –MTH 101)

Geometric representation of vectors in 1-3 dimensions, components, direction cosines. Addition, scalar, multiplication of vectors, linear independence. Scalar and vector products of two vectors. Differentiation and integration of vectors with respect to a scalar variable. Two-dimensional co-ordinate geometry. Straight lines, circles, parabola, ellipse, hyperbola. Tangents, normals. Kinematics of a particle. Components of velocity and acceleration of a particle moving in a plane. Force, momentum, laws of motion under gravity, projectiles and resisted vertical motion. Elastic string and simple pendulum. Impulse, impact of two smooth spheres and a sphere on a smooth surface.

PHY 101: General Physics I (Mechanics) (2 Units C: LH 30)

Learning Outcomes

On completion, the students should be able to:
1. identify and deduce the physical quantities and their units;
2. differentiate between vectors and scalars;
3. describe and evaluate motion of systems on the basis of the fundamental laws of mechanics;
4. apply Newton's laws to describe and solve simple problems of motion;
5. evaluate work, energy, velocity, momentum, acceleration, and torque of moving or rotating objects;
6. explain and apply the principles of conservation of energy, linear and angular momentum;
7. describe the laws governing motion under gravity; and
8. explain motion under gravity and quantitatively determine behaviour of objects moving under gravity.

Course Contents

Space and time; units and dimension, vectors and scalars, differentiation of vectors: displacement, velocity and acceleration; kinematics; Newton's laws of motion (inertial frames, impulse, force and action at a distance, momentum conservation); relative motion; application of Newtonian mechanics; equations of motion; conservation principles in physics, conservative forces, conservation of linear momentum, kinetic energy and work, potential energy, system of particles, centre of mass; rotational motion; torque, vector product, moment, rotation of coordinate axes and angular momentum. Polar coordinates; conservation of angular momentum; circular motion; moments of inertia, gyroscopes and precession; gravitation: Newton's law of gravitation, Kepler's laws of planetary motion, gravitational potential energy, escape velocity, satellites motion and orbits.

PHY 103: General Physics III (Behaviour of Matter) (2 Units C: LH 30)

Learning Outcomes

On completion, the students should be able to:
1. explain the concepts of heat and temperature and relate the temperature scales;
2. define, derive and apply the fundamental thermodynamic relations to thermal systems;
3. describe and explain the first and second laws of thermodynamics, and the concept of entropy;
4. state the assumptions of the kinetic theory and apply techniques of describing macroscopic

behaviour;
5. deduce the formalism of thermodynamics and apply it to simple systems in thermal equilibrium; and
6. describe and determine the effect of forces and deformation of materials and surfaces.

Course Contents
Heat and temperature, temperature scales; gas laws; general gas equation; thermal conductivity; first Law of thermodynamics; heat, work and internal energy, reversibility; thermodynamic processes; adiabatic, isothermal, isobaric; second law of thermodynamics; heat engines and entropy, Zero's law of thermodynamics; kinetic theory of gases; molecular collisions and mean free path; elasticity; Hooke's law, Young's shear and bulk moduli; hydrostatics; pressure, buoyancy, Archimedes' principles; Bernoullis equation and incompressible fluid flow; surface tension; adhesion, cohesion, viscosity, capillarity, drops and bubbles.

PHY 107: General Practical Physics I (1 Unit C: PH 45)
Learning Outcomes
On completion, the student should be able to:
1. conduct measurements of some physical quantities;
2. make observations of events, collect and tabulate data;
3. identify and evaluate some common experimental errors;
4. plot and analyse graphs; and
5. draw conclusions from numerical and graphical analysis of data.

Course Contents
This introductory course emphasizes quantitative measurements. Experimental techniques. The treatment of measurement errors. Graphical analysis. The experiments include studies of meters, the oscilloscope, mechanical systems, electrical and mechanical resonant systems, light, heat, viscosity, etc. (covered in PHY 101, 102, 103 and PHY 104). However, emphasis should be placed on the basic physical techniques for observation, measurements, data collection, analysis, and deduction.

MEE 101: Introduction to Mechanical Engineering (1 Units C: LH 15)
Learning Outcomes:
At the end of this course, the students should be able to:
1. differentiate between science, engineering and technology, and relate them to innovation;
2. identify the various branches of mechanical engineering discipline and their applications to the solution of societal problems;
3. demonstrate appreciation of the problem of climate change; and
4. demonstrate appreciation of the role of energy systems to environmental sustainability.

Course Contents
Historical development of the mechanical engineering discipline. Philosophy and scope of contemporary mechanical engineering course programme. Overview of mechanical engineering special fields: applied (solid) mechanics, fluid and thermal engineering (thermodynamics and heat transfer). Industrial/production engineering and engineering management sciences. The linkage between mechanical engineering and other engineering disciplines and the sciences. The concept of innovation. Illustrations of a wide variety applications of mechanical engineering. The role of mechanical engineers in the society and

human development. Professional ethical responsibility. Climate change, renewable energy and environmental sustainability.

UAES - AGR 101 Farm Practice I (1 Unit; C; LH =0; PH = 45)

Learning outcomes

It is expected that at the end of this practical course, the students will be able to:

1. identify at least three (3) tools for record keeping;
2. identify at least three (3) tools for farm inventory;
3. describe four (4) factors to consider in making a choice of farm enterprise;
4. identify and describe at least five (5) structures in the farms;
5. identify at least three (3) crops based on their life span;
6. identify at least three (3) types of fish;
7. identify at least three (3) types of livestock species;
8. describe at least four (4) common practices in livestock;
9. describe at least four (4) common practices in fish production;
10. describe at least four (4) farm machineries; and
11. State at least four (4) uses of farm machineries.

Course Contents

Meaning and types of Farm enterprise. Choice of farm enterprise and factors to consider in selecting a farm enterprise. Site selection for farm enterprise and factors to consider. Farm records and inventory. Tools used in farm record and inventory. Importance of record and inventory keeping in farm enterprise. Farm layout and design. Factors to consider in farm layout design. Farm infrastructure and their relevance in the modern farming activities. Classification of crops according to lifespan and product. Some forest plant species and the economic values. Classes of pests and their implications in crop production as well as control measures. Common management practices in animal husbandry. Fish culture. Fishing and common fishing equipment. Farm machineries and simple equipment. Uses and maintenance of farm machineries/equipment.

UAES-LEP-105 - Language Enhancement Programme (Igbo) I (1 Unit, Core, LH= 15)

Learning Outcomes

At the end of learning this course, the students should be able to:

1. Understand, explain and list the current Igbo orthography.
2. Differentiate between Igbo orthography and speech sounds.
3. Identify Igbo terminologies peculiar to their fields of study.
4. Apply the knowledge of the terminologies in research and practice.
5. Communicate fluently in Igbo.

Course Contents

Introduction to language, Igbo language and its orthography. Outlining and understanding the word formation processes in Igbo. Learning the organs of speech and the speech sounds they produce. Outlining and understanding the spelling rules in Igbo. Learning of numbers. The concept of tone and tone marking. Punctuations marks, their importance and uses.

UAES-LEP-105 - Language Enhancement Programme (French) I (1 Unit, Core, LH= 15)

Learning Outcomes

On completion of the course, students should be able to:

1. Read French texts.
2. Speak French up to proficient level.
3. Write basic expressions in French,
4. Converse in simple everyday French,
5. Identify simple French lexis and structure.
6. Identify simple French spellings,
7. Describe people,
8. Explain French civilization and culture.

Course Contents

French alphabet and pronunciation. Greetings in French. Using the Definite and Indefinite articles. /Introducing one's self. Cardinal and ordinal numbers with age. Describe someone (physical appearance and personal traits) +adjectives. /Seasons of the world(Europe and Africa). Parts of the body and saying where it hurts.

UAES - ENG-101 Introduction to Engineering Workshop Practice (1 Unit; C; LH = 0; PH = 45)

Learning Outcomes

At the end of this course, the students should be able to:

1. describe at least three (3) basic workshop settings;
2. state at least five (5) safety precautions/rules used in workshop environments;
3. identify at least four (4) different elementary machines used in manufacturing;
4. identify at least four (4) different basic hands tools used in manufacturing;
5. apply basic plumbing skills in installation and maintenance of at least two (2) machines;
6. apply elementary engineering skills in wood and metal works;
7. identify at least five joining operations;
8. perform at least three (3) joining operations; and
9. Identify at least four (4) types of workshop equipment.

Course Contents

Workshop setting. Safety precautions. Bench tools. Hands tools. Power tools. Introduction to workshop equipment. Marking, itching, sampling, and sizing techniques of raw materials. Introduction to woodwork. Elementary metalwork. Drilling operations. Boring and counter boring. Tapping and reaming operations. Counter sinking. Joining techniques. Gas and arc welding. Holding devices. Elementary plumbing work.

100 LEVEL (SECOND SEMESTER COURSE)

GST 112: Nigerian Peoples and Cultures (2 Units C: LH 30)

Learning Outcomes

At the end of this course, students should be able to:

1. analyse the historical foundation of Nigerian cultures and arts in pre-colonial times;

2. identify and list the major linguistic groups in Nigeria;
3. explain the gradual evolution of Nigeria as a political entity;
4. analyse the concepts of trade and economic self-reliance of Nigerian peoples in relation to national development;
5. enumerate the challenges of the Nigerian state regarding nation building;
6. analyse the role of the judiciary in upholding fundamental human rights
7. identify the acceptable norms and values of the major ethnic groups in Nigeria; and
8. list possible solutions to identifiable Nigerian environmental, moral and value problems.

Course Contents
Nigerian history, culture and art up to 1800 (Yoruba, Hausa and Igbo peoples and cultures; peoples and cultures of the minority ethnic groups). Nigeria under colonial rule (advent of colonial rule in Nigeria; colonial administration of Nigeria). Evolution of Nigeria as a political unit (amalgamation of Nigeria in 1914; formation of political parties in Nigeria; nationalist movement and struggle for independence). Nigeria and challenges of nation building (military intervention in Nigerian politics; Nigerian Civil War). Concepts of trade and economics of self-reliance (indigenous trade and market system; indigenous apprenticeship system among Nigerian peoples; trade, skill acquisition and self-reliance). Social justice and national development (definition and classification of law); Judiciary and fundamental rights. Individuals, norms and values (basic Nigerian norms and values, patterns of citizenship acquisition; citizenship and civic responsibilities; indigenous languages, usage and development; negative attitudes and conducts [Cultism, kidnapping and other related social vices]). Re-orientation, moral and national values (The 3Rs – Reconstruction, Rehabilitation and Re-orientation; re-orientation strategies: Operation Feed the Nation (OFN), Green Revolution, Austerity Measures, War Against Indiscipline and Corruption (WAIC), Mass Mobilization for Self-Reliance, Social Justice and Economic Recovery (MAMSER), National Orientation Agency (NOA). Current socio-political and cultural developments in Nigeria.

GET 102: Engineering Graphics and Solid Modelling I (2 Units C: LH 15; PH 45)

Learning Outcomes
At the end of this course, the students should be able to:
1. have a good grasp of design thinking and be obsessed with the determination to apply such to solving simple everyday and also complex problems;
2. recognise the fundamental concepts of engineering drawing and graphics;
3. show skills to represent the world of engineering objects in actionable solid models, and put such models in a form where they can be inputs for simulation and analyses;
4. analyse such models for strength and cost;
5. prepare the objects for modern production and manufacturing techniques of additive and subtractive manufacturing;
6. recognise that engineering is multidisciplinary in the sense that mechanical, electrical and other parts of physical structures are modelled in context as opposed to the analytical nature of the courses they take; and

7. analyse and master the basics of mechanical and thermal loads in engineering systems.

Course Contents

Introduction to design thinking and engineering graphics. First and third angle orthogonal projections. Isometric projections; sectioning, conventional practices, conic sections and development. Freehand and guided sketching – pictorial and orthographic. Visualisation and solid modelling in design, prototyping and product-making. User interfaces in concrete terms. Design, drawing, animation, rendering and simulation workspaces. Sketching of 3D objects. Viewports and sectioning to shop drawings in orthographic projections and perspectives. Automated viewports. Sheet metal and surface modelling. Material selection and rendering. This course will use latest professional design tools such as fusion 360, solid works, solid edge or equivalent.

CHM 102: General Chemistry II (2 Units C: LH 30)

Learning Outcomes

At the end of this course, the students should be able to:

1. state the importance and development of organic chemistry;
2. define fullerenes and its applications;
3. discuss electronic theory;
4. determine the qualitative and quantitative of structures in organic chemistry;
5. state rules guiding nomenclature and functional group classes of organic chemistry;
6. determine the rate of reaction to predict mechanisms of reaction;
7. identify classes of organic functional group with brief description of their chemistry;
8. discuss comparative chemistry of group 1A, IIA and IVA elements; and
9. describe basic properties of transition metals.

Course Contents

Historical survey of the development and importance of organic chemistry; fullerenes as fourth allotrope of carbon, uses as nanotubules, nanostructures, nanochemistry. Electronic theory in organic chemistry. Isolation and purification of organic compounds; determination of structures of organic compounds including qualitative and quantitative analysis in organic chemistry; nomenclature and functional group classes of organic compounds. Introductory reaction mechanism and kinetics. Stereochemistry. The chemistry of alkanes, alkenes, alkynes, alcohols, ethers, amines, alkyl halides, nitriles, aldehydes, ketones, carboxylic acids and derivatives. The chemistry of selected metals and non-metals. Comparative chemistry of group IA, IIA and IVA elements. Introduction to transition metal chemistry.

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

Learning Outcomes

At the end of this course, the students should be able to:

1. state the general laboratory rules and safety procedures;
2. collect scientific data and correctly carry out chemical experiments;
3. identify the basic glassware and equipment in the laboratory;
4. identify and carry out preliminary tests which include ignition, boiling point, melting point, test on known and unknown organic compounds;
5. carry out solubility tests on known and unknown organic compounds;
6. carry out elemental tests on known and unknown compounds; and

7. carry out functional group/confirmatory test on known and unknown compounds which could be acidic/basic/ neutral organic compounds.

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

MTH 102: Elementary Mathematics II (Calculus) (2 Units C: LH 30)

Learning Outcomes
At the end of the course, students should be able to:
1. identify the types of rules in differentiation and integration;
2. recognise and understand the meaning of function of a real variable, graphs, limits and continuity;
3. solve some applications of definite integrals in areas and volumes;
4. solve function of a real variable, plot relevant graphs, identify limits and idea of continuity;
5. identify the derivative as limit of rate of change;
6. identify techniques of differentiation and perform extreme curve sketching;
7. identify integration as an inverse of differentiation;
8. identify methods of integration and definite integrals; and
9. perform integration application to areas, volumes.

Course Contents
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).

PHY 108: General Practical Physics II (1 Unit C: PH 45)
Learning Outcomes
On completion, the student should be able to:
1. conduct measurements of some physical quantities;
2. make observations of events, collect and tabulate data;
3. identify and evaluate some common experimental errors;
4. plot and analyse graphs;
5. draw conclusions from numerical and graphical analysis of data; and
6. prepare and present practical reports.

Course Contents
This practical course is a continuation of PHY 107 and is intended to be taught during the second semester of the 100 level to cover the practical aspect of the theoretical courses that have been covered with emphasis on quantitative measurements, the treatment of measurement errors, and graphical analysis. However, emphasis should be placed on the basic physical techniques for observation, measurements, data collection, analysis and deduction.

UAES - AGR 102 Farm Practice II (1 Unit; C; LH = 0; PH = 45)
Learning outcomes
It is expected that at the end of this practical course, students should be able to:
1. identify and describe at least four (4) horticultural crops;
2. explain at least three (3) branches of horticulture/classes of horticultural crops;

3. describe at least two (2) ways on how to establish/manage horticultural crops;
4. describe nursery practices/operations for crops;
5. describe budding and grafting;
6. describe at least four (4) tools for seedling transplanting;
7. describe at least three technics for establishing a homestead vegetable farm;
8. describe at least four (4) factors influencing crop farming in Nigeria.

Course contents
Meaning and branches of horticulture. Classification of horticultural crops. Nursery practices for horticultural crops. Establishment and management of horticultural crops. Methods of propagating horticultural crops. Budding and grafting practices. Importance of horticultural crops to micro and macro economy. Nursery practices for field crops. Establishment of field crops (transplanting technics). Economics of shrubs and tree crops in Nigeria. Climatic, biotic, edaphic and socioeconomic factors influencing the production of horticultural and field crops in different agro-ecological zones in Nigeria. Management of environmental factors for crop production for crop production. Principle of homestead farming and its relevance on household economy.

UAES - EMT 102 Environmental and Public Health (1 Unit; C; LH =15; PH = 0)
Learning Outcomes
At the end of the course, students should be able to:
1. describe at least three (3) terms used in Environmental health;
2. describe the historical background of environmental and public health;
3. describe at least three (3) public health laws in Nigeria;
4. state at least three (3) principles of environmental health;
5. outline at least four (4) pillars of environmental health;
6. describe health in relation to environment;
7. state at least four (4) effects of man's activities on family health.

Course Contents
Terms used in Environmental health: Environment, health, agent, host, public health, sanitation and hygiene. History of Environmental health including Mosaic laws (Torah), Hippocrates, Sir Edwin Chadwick. Introduction of public health laws in Nigeria. Health organizations: World Health Organization (WHO). United Nations (UNDP, UNICEF). International Federation of Environmental Health (IFEH) and others. Principles of Environmental Health: protection of public health and the environment. Qualitative and quantitative risk assessment. Pillars of Environmental Health: community health, water quality, air quality. Pollution and control. Built environment, food quality and industrial hygiene, management. Health and Environment: Agent factors. Environmental factors. Host factors. Health risk assessment, environmental management, mitigation. Effects of man's domestic, industrial and other anthropogenic activities on individual and family health. Ameliorative measures to maintain environmental health. Application of recent health models and theories.

UAES - PHY 102 General Physics II (2 Units; C; LH =30; PH = 0)
Learning Outcomes
At the end of this course, the student should be able to:
1. describe electric field potential;
2. state at least two (2) concepts for stationary charges;
3. calculate three (3) electrostatic properties of simple charge distributions;
4. determine the magnetic field for steady charges;

5. determine the magnetic field for moving charges;
6. determine at least two (2) magnetic properties of simple current distributions;
7. describe electromagnetic induction;
8. apply Faraday and Lenz's laws in calculations;
9. explain the basic physical properties of Maxwell's equations in integral form;
10. evaluate DC circuits to determine the electrical parameters; and
11. describe at least three (3) characteristics of AC voltages.

Course Contents

Forces in nature. Electrostatics; electric charge and its properties, methods of charging. Coulomb's law and superposition. Electric field and potential. Gauss's law. Capacitance. Electric dipoles. Energy in electric fields. Conductors and insulators, current, voltage and resistance. Ohm's law and analysis of DC circuits. Magnetic fields. Lorentz force. Biot-Savart and Ampère's laws. Magnetic dipoles. Dielectrics. Energy in magnetic fields. Electromotive force. Electromagnetic induction. Self and mutual inductances. Faraday and Lenz's laws. Step up and step-down transformers: Maxwell's equations. Electromagnetic oscillations and waves. AC voltages and currents applied to inductors, capacitors, resistance, and combinations.

UAES - PHY 104 General Physics IV (2 Units; C; LH =30; PH = 0)

Learning Outcomes

At the end of the course, students should be able to:

1. analyze the behaviour of vibrating systems;
2. describe wave energy;
3. state at least three (3) properties of sound and light waves;
4. apply wave equations to solve problems;
5. describe at least two (2) patterns of light reflection;
6. describe at least three (3) spherical phases;
7. describe Huygens's principle;
8. describe at least two (2) geometrical optics;
9. state principles of optical instruments; and
10. describe Doppler effect.

Course Contents

Simple harmonic motion (SHM). Energy in a vibrating system. Damped SHM. Q values and power response curves. Forced SHM. Resonance and transients. Coupled SHM. Normal modes. Types and properties of waves as applied to sound. Transverse and Longitudinal waves. Superposition. Interference. Diffraction. Dispersion. Polarization. Waves at interfaces. Energy and power of waves. The 1-D wave equation. 2-D and 3-D wave equations. Wave energy and power. Phase and group velocities. Echo. Beats. The Doppler Effect. Propagation of sound in gases, solids and liquids and their properties. Nature and propagation of light. Reflection. Refraction, and internal reflection. Dispersion. Scattering of light. Reflection and refraction at plane. Spherical surfaces. Thin lenses and optical instruments. Wave nature of light. Huygens's principle. Interference and diffraction.

UAES- STA 112 Probability I (3 Units; C; LH =45; PH = 0)

Learning Outcomes

At the end of the course, students should be able to:

1. state at least three (3) differences between permutation and combination;
2. explain the concept of random variables;
3. apply random variables to probability and distribution functions;
4. state at least three (3) basic distribution functions.
5. explain the concept of exploratory data analysis.
6. apply at least two (2) statistical software for data analysis;
7. apply regression analysis for solving problems;
8. generate unique data from pools of experimental data;
9. design an experiment using at least two (2) different software.

Course Contents

Permutation. Combination. Concepts and principles of probability. Random variables. Probability and distribution functions. Binomial, geometric, Poisson, normal and sampling distribution. F- Distribution. Binomial Distribution. Poisson distribution. Parameter estimation. Mean, Variance and Standard deviation. Exploratory data analysis. Multivariate statistics. Large Sampling theory. Regression Analysis. Regression models. Model Validation. Design of experiments. Factorial Design Models.

UAES-LEP-108 - Language Enhancement Programme (Igbo) II (1 Unit, Core, LH= 15)
Learning outcomes

At the end of learning this course, the students should be able to:
1. Understand, explain and list the current Igbo orthography.
2. Differentiate between Igbo orthography and speech sounds.
3. Identify Igbo terminologies peculiar to their fields of study.
4. Apply the knowledge of the terminologies in research and practice.
5. Communicate fluently in Igbo.

Course Contents

Brief history of the Igbo people and their culture. Igbo grammar - parts of speech and affixation. Understanding the syllable and syntactic structures of the Igbo language. Figures of speech. Outlining and understanding the word duplication processes in Igbo. Essay writing. Introduction to the institutions, traditions and customs of the Igbo people.

UAES-LEP-108 - Language Enhancement Programme (French) II (1 Unit, Core, LH= 15)

On completion of the course, students should be able to:

1. Read French texts.
2. Speak French up to proficient level.
3. Write basic expressions in French,
4. Converse in simple everyday French,
5. Identify simple French lexis and structure.
6. Identify simple French spellings,
7. Describe people,
8. Explain French civilization and culture.

Course Content

Formation of negative sentences in French. Family tree and hobbies. Talk about Jobs and professions. Identify and describe nationalities and African countries and capitals. Saying the time : *quelle heure est-il* ? Regular verbs conjugation. Irregular verb conjugation. ‘’avoir’’, ‘’etre’’, ‘’pouvoir’’, ‘’falloir’’ etc/

200 LEVEL (FIRST SEMESTER COURSE)

ENT 211: Entrepreneurship and Innovation (2 Units C: LH 30)

Learning Outcomes

At the end of this course, students should be able to:

1. explain the concepts and theories of entrepreneurship, intrapreneurship, opportunity seeking, new value creation and risk-taking;
2. state the characteristics of an entrepreneur;
3. analyse the importance of micro and small businesses in wealth creation, employment generation and financial independence;
4. engage in entrepreneurial thinking;
5. identify key elements in innovation;
6. describe the stages in enterprise formation, partnership and networking, including business planning;
7. describe contemporary entrepreneurial issues in Nigeria, Africa and the rest of the world; and
8. state the basic principles of e-commerce.

Course Contents

The concept of entrepreneurship (entrepreneurship, intrapreneurship/corporate entrepreneurship); theories, rationale and relevance of entrepreneurship (Schumpeterian and other perspectives, risk-taking, necessity and opportunity-based entrepreneurship, and creative destruction); characteristics of entrepreneurs (opportunity seeker, risk-taker, natural and nurtured, problem solver and change agent, innovator and creative thinker); entrepreneurial thinking (critical thinking, reflective thinking and creative thinking). Innovation (The concept of innovation, dimensions of innovation, change and innovation, knowledge and innovation). Enterprise formation, partnership and networking (basics of business plan, forms of business ownership, business registration and alliance formation, and joint ventures). Contemporary entrepreneurship issues (knowledge, skills and technology, intellectual property, virtual office and networking). Entrepreneurship in Nigeria (biography of inspirational entrepreneurs, youth and women entrepreneurship, entrepreneurship support institutions, youth enterprise networks and environmental and cultural barriers to entrepreneurship). Basic principles of e-commerce.

GET 201: Applied Electricity I (3 Units C: LH 30; PH 45)

Learning Outcomes

Students will be able to:

1. discuss the fundamental concepts of electricity and electrical d.c. circuits;

2. state, explain and apply the basic d.c. circuit theorems;
3. explain the basic a.c. circuit theory and
4. apply to solution of simple circuits.

Course contents
Fundamental concepts: Electric fields, charges, magnetic fields. current, B-H curves Kirchhoff's laws, superposition. Thevenin, Norton theorems, Reciprocity, RL, RC, RLC circuits. DC, AC bridges, Resistance, Capacitance, Inductance measurement, Transducers, Single phase circuits, Complex j - notation, AC circuits, impedance, admittance, susceptance.

GET 205: Fundamentals of Fluid Mechanics (3 Units C: LH 45)

Learning Outcomes
At the end of this course, the students should be able to :
1. explain the properties of fluids;
2. determine forces in static fluids and fluids in motion;
3. determine whether a floating body will be stable;
4. determine the effect of various pipe fittings (valves, orifices, bends and elbows) on fluid flow in pipes;
5. measure flow parameters with venturi meters, orifice meters, weirs;
6. perform calculations based on principles of mass, momentum and energy conservation;
7. perform dimensional analysis and simple fluid modelling problems; and
8. specify the type and capacity of pumps and turbines for engineering applications.

Course Contents
Fluid properties, hydrostatics, fluid dynamics using principles of mass, momentum and energy conservation from a control volume approach. Flow measurements in pipes, dimensional analysis, and similitude, 2-dimensional flows. Hydropower systems.

GET 209: Engineering Mathematics I (3 Units C: LH 45)

Learning Outcomes
At the end of the course, the students should be able to:
1. solve qualitative problems based on vector and matrix analyses such as linear independence and dependence of vectors, rank etc;
2. describe the concepts of limit theory and nth order differential equations and their applications to physical phenomena;
3. solve the problems of differentiation of functions of two variables and know about the maximization and minimization of functions of several variables;
4. describe the applications of double and triple integration in finding the area and volume of engineering solids, and explain the qualitative applications of Gauss, Stoke's and Green's theorem;
5. explain ordinary differential equations and applications, and develop a mathematical model of linear differential equations, as well as appreciate the necessary and sufficient conditions for total differential equations; and
6. analyse basic engineering models through partial differential equations such as wave

equation, heat conduction equation, etc., as well as fourier series, initial conditions and its applications to different engineering processes

Course Contents
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: Computing and Software Engineering (3 Units C: LH 30; PH 45)
Learning Outcomes
At the end of the course, the students should be able to:
1. describe and apply computing, software engineering knowledge, best practices, and standards appropriate for complex engineering software systems;
2. develop competence in designing, evaluating, and adapting software processes and software development tools to meet the needs of an advanced development project through practical object-oriented programming exposure taught in concrete terms with a specific modern language – preferable selected from Python, Java or C++;
3. use widely available libraries to prepare them for machine learning, graphics and design simulations;
4. develop skills in eliciting user needs and designing an effective software solution;
5. recognise human, security, social, and entrepreneurial issues and responsibilities relevant to engineering software and the digitalisation of services; and
6. acquire capabilities that can further be developed to make them productively employable by means of short Internet courses in specific areas;

Course Contents
Introduction to computers and computing; computer organisation – data processing, memory, registers and addressing schemes; Boolean algebra; floating-point arithmetic; representation of non-numeric information; problem-solving and algorithm development; coding (solution design using flowcharts and pseudo codes). Data models and data structures; computer software and operating system; computer operators and operators precedence; components of computer programs; introduction to object oriented, structured and visual programming; use of MATLAB in engineering applications. ICT fundamentals, Internet of Things (IoT). Elements of software engineering.

GET 299: Students Industrial Work Experience I (3 Units C: 9 weeks)

Learning Outcomes
SIWES I should provide opportunity for the students to:
1. acquire industrial workplace perceptions, ethics, health and safety consciousness, inter-personal skills and technical capabilities needed to give them a sound engineering foundation;
2. learn and practise basic engineering techniques and processes applicable to their specialisations;
3. build machines, devices, structures or facilities relevant to their specific engineering programmes and applications; and

4. acquire competence in technical documentation (log-book) and presentation (report) of their practical experiences.

Course Contents
Practical experience in a workshop or industrial production facility, construction site or special centres in the university environment, considered suitable for relevant practical/industrial working experience but not necessarily limited to the student's major. The students are exposed to hands-on activities on workshop safety and ethics, maintenance of tools, equipment and machines, welding, fabrication and foundry equipment, production of simple devices; electrical circuits, wiring and installation. (8-10 weeks during the long vacation following 200 level).

NOTE: Each programme to indicate additional details of programme-specific activities for their students.

UAES- AGR 201 Farm Practice III (1 Unit; C; LH = 0; PH = 45)

Learning outcomes

It is expected that at the end of this practical course, students should be able to:

1. describe landscaping and floriculture;
2. describe at least three (3) tropical ornamental plants;
3. describe propagation of ornamental plants;
4. describe the nursery practices in the production of ornamental plants;
5. describe the procedure for lawn establishment and maintenance;
6. describe landscaping as a business;
7. describe at least four (4) importance of landscaping; and
8. State three (3) differences between horticulture and floriculture.

Course contents

Meaning of landscape and types of landscapes. Landscaping and types of landscaping. Floricultural practices. Identification of plants for landscaping and floricultural significance. Design of landscapes. Best practices and landscaping. Factors to consider before land scaping a site. Nursery practices for landscaping and floricultural plants. Lawn establishment and maintenance. Sources of planting materials in floriculture. Multipurpose values in some floricultural plants. Survey and selection of lands for landscaping. Land evaluation for floriculture. Soil characteristics and soil quality for land scaping. The use soilless media for floriculture. Land improvements practices during landscaping. Landscape practices in urban and metropolitan cities. Application of cartography in floriculture. Management of pests and diseases in floriculture. Water harvesting and storage for floricultural crops. Economics of floricultural crops.

UAES- EMT 201 Occupational Safety (1 Unit; C; LH =15; PH = 0)

Learning outcomes
At the end of the course, students should be able to:

1. describe at least four (4) risks associated with the work place;
2. list at least four (4) ways to mitigate work place hazards;
3. state at least three (3) key elements of a safety management system in workplace operations;

4. describe measures to reduce fatality rate at the workplace;
5. state at least five (5) benefits of compliance with safety regulations;
6. describe standards for the management of health and safety in workplace;
7. state at least four (4) importance of safety awareness in the workplace;
8. describe at least three (3) emergency measures at the workplace.

Course Contents

Creating a Culture of Safety. Specific Workplace Hazards. Risk Management. Emergency Preparedness and Business Continuity. Common Worksite Incidents and Fatalities. Fire Prevention. Exposure to Industrial Chemicals and Fumes. Blood borne Pathogens and Needle stick Prevention. Ergonomics. Preventing Workplace Violence. Safety Committees. Safety and Health Training. Safety Clothing and Apparels. Job Hazard Analysis. Incident Investigation. Noise at Workplace. Oil and Gas Industry Safety – Onshore and Offshore. Construction Industry Safety. Fibrous Minerals and Dust - Managing the Risk. International and Nigerian Regulations. Benefits of Regulatory Compliance. Workers' Compensation.

UAES- GET 207 Applied Mechanics (3 Units; C; LH = 45; PH = 0)

Learning Outcomes

It is expected that at the end of this practical course, the students will be able to:

1) describe at least three (3) fundamental principles of applied mechanics;
2) apply at least two (2) principles of engineering to solve complex problems;
3) identify at least three (3) complex engineering problems;
4) determine the complete load impact;
5) apply at least two (2) engineering design principles;
6) use at least two (2) computer software to solve mechanics problems;
7) Draw Shear forces and bending moments diagrams; and
8) Determine deflection of beams.

Course Contents

Forces. Moments. Couples. Equilibrium of simple structures and machine parts. Friction. First and second moments of area. Centroids. Kinematics of particles in plane motion. Kinematics of rigid bodies in plane motion. Free body diagram. Newton's laws of motion. Kinetic energy and momentum analyses. Hooke's law. Stresses and strain due to loading and temperature changes. Shear forces. Work. Power. Energy. Torsion. Stress circle. Deflection of beams with symmetrical. Deflection of beams with combined loadings. Resultant of coplanar forces. Elastic buckling of columns. Shear forces and bending moments. Bending moment diagrams. Analytical methods for structures.

UAES- MEE 213 Metrology and Instrumentation (2 Units; C; LH =15; PH = 45)

Learning Outcomes

At the end of the course, the students should be able to:

1) state at least three fundamental quantities of measurement;
2) State the methods of measurement errors associated with measurement
3) State various types of errors;
4) state the concept of limits and fits;
5) use at least six instruments for linear and angular measurements;
6) state the techniques used in optical inspection and measurement;
7) state three types of surface traces;

8) state at least three methods of measuring surface roughness;
9) list at least seven mechanical devices;
10) describe six principles used in measurement of mechanical devices;
11) explain three physical quantities of measurement; and
12) List various instruments for measuring pressure and temperature.

Course Contents
Basic principles of engineering metrology. Standards of measurement. Measurement systems. Transducers. Measurement of force. Torque. Strain. Metrology of gears and screw threads. Theory and practice of high precision. Measurement temperature. Measurement of pressure. Mechanical measurements under strict control conditions. Super micrometry. Comparator profilometry. Collimators application in machine installations. Tolerances and quality. Fits Clearance. Fits Transition. Interference fits. Optical measurement and interferometry. Comparators. Inspection and quality control.

200 LEVEL (SECOND SEMESTER COURSE)

GST 212: Philosophy, Logic and Human Existence (2 Units C: LH 30)Learning Outcomes

At the end of the course, students should be able to:

1. know the basic features of philosophy as an academic discipline;
2. identify the main branches of philosophy & the centrality of logic in philosophical discourse;
3. know the elementary rules of reasoning;
4. distinguish between valid and invalid arguments;
5. think critically and assess arguments in texts, conversations and day-to-day discussions;
6. critically assess the rationality or otherwise of human conduct under different existential conditions;
7. develop the capacity to extrapolate and deploy expertise in logic to other areas of knowledge, and
8. guide his or her actions, using the knowledge and expertise acquired in philosophy and logic.

Course Contents
Scope of philosophy; notions, meanings, branches and problems of philosophy. Logic as an indispensable tool of philosophy. Elements of syllogism, symbolic logic— the first nine rules of inference. Informal fallacies, laws of thought, nature of arguments. Valid and invalid arguments, logic of form and logic of content — deduction, induction and inferences. Creative and critical thinking. Impact of philosophy on human existence. Philosophy and politics, philosophy and human conduct, philosophy and religion, philosophy and human values, philosophy and character molding.

GET 202: Engineering Materials (3 Units C: LH 45)

Learning Outcomes

At the end of this course, the students should be able to:

1. demonstrate the role of atoms and molecules (aggregates of atoms) in the building of solid/condensed matter known as engineering materials, the electrons quantum numbers and how the electrons are arranged in different atomic elements, and explain the role of electronic configuration and valence electrons in bonding;
2. define metals, alloys and metalloids, demonstrate mental picture of the solid mineral resources development as a relay race among four 'athletes': geologist, mining engineer, mineral processing technologist, process metallurgical engineer, and classify metallurgical engineering into 3Ps: process, physical and production;
3. explain the relationship between structure and properties of materials, characteristics, components and compositions of phase diagrams and phase transformations of solid solutions;
4. define ceramics, glass and constituents of glasses and understand application of ceramics in mining, building, art and craft industries;
5. define and classify polymers as a class of engineering materials and polymeric materials, demonstrate polymerisation reactions, their types and mechanism, and applications of polymers;
6. define properties, types and application of composite materials and fibres (synthetic and natural);
7. define and classify nanomaterials, demonstrate applications of nanomaterials, concept, design and classification of fracture mechanics, corrosion classification, including the five principal ways of controlling corrosion and metal finishing processes such as sherardising, galvanising and anodising; and
8. identify factors affecting the performance and service life of engineering materials/metals and metallography of metals/materials (materials anatomy), which enables metallurgical and materials engineers to prescribe appropriate solutions to test metals/materials fitness in service through structure-property-application relationships.

Course Contents

Basic material science; atomic structure, atomic bonding and crystal structures. Engineering materials situating metals and alloys; metals and alloys, classifications of metals, metal extraction processes using iron and steel (ferrous) and aluminium (nonferrous) as examples, phase diagrams/iron carbon diagrams, and mechanical workings of metals. Selection and applications of metals and alloys for specific applications in oil, aerospace, construction, manufacturing and transportation industries, among others. Ceramics (including glass); definition, properties, structure and classifications of ceramics. Bioactive and glass – ceramics. Toughing mechanism for ceramics. Polymers; definition of polymers as engineering materials, chemistry of polymeric materials, polymer crystallisation, polymer degradation and aging. Thermoplastic and thermosetting polymers and concepts of copolymers and homopolymers. Composites; definition, classification, characterisation, properties and composite. Applications of composites. Nanomaterials; definition, classification and applications of nanomaterials as emerging technology. Processing of nanomaterials including mechanical grinding, wet chemical synthesis, gas phase synthesis, sputtered plasma processing, microwave plasma processing and laser ablation. Integrity assessment of engineering materials; effect of engineering design, engineering materials

processing, selection, manufacturing and assembling on the performance and service life of engineering materials. Metallography and fractography of materials. Mechanical testing (destructive testing) of materials such as compressive test, tensile test, hardness test, impact test, endurance limit and fatigue test. Non-destructive test (NDT) such as dye penetrant, x-ray and eddy current.

GET 204: Students Workshop Practice (2 Units C: LH 15; PH 45)

Learning Outcomes

At the end of this course, the students should be able to:

1. identify various basic hands and machine tools, analogue and digital measurement devices and instruments, and acquire skills in their effective use and maintenance;
2. practically apply basic engineering technologies, including metrology, casting, metal forming and joining, materials removal, machine tooling (classification, cutting tool action, cutting forces, non-cutting production) and CNC machining technology;
3. master workshop and industrial safety practices, accident prevention and ergonomics;
4. physically recognise different electrical & electronic components like resistances, inductances, capacitances, diodes, transistors and their ratings;
5. connect electric circuits, understand different wiring schemes, and check ratings of common household electrical appliances and their basic maintenance; and
6. determine household and industrial energy consumption, and understand practical energy conservation measures.

Course Contents

The course comprises general, mechanical and electrical components: supervised hands-on experience in safe usage of tools and machines for selected tasks; Use of measuring instruments (calipers, micrometers, gauges, sine bar, wood planners, saws, sanders, and pattern making). Machine shop: lathe work shaping, milling, grinding, reaming, metal spinning. Hand tools, gas and arc welding, cutting, brazing and soldering. Foundry practice. Industrial safety and accident prevention, ergonomics, metrology. Casting processes. Metal forming processes: hot-working and cold-working processes (forging, press-tool work, spinning, etc.). Metal joining processes(welding, brazing and soldering). Heat treatment. Material removal processes. machine tools and classification. Simple theory of metal cutting. Tool action and cutting forces. Introduction to CNC machines. Supervised identification, use and care of various electrical and electronic components such as resistors, inductors, capacitors, diodes and transistors. Exposure to different electric circuits, wiring schemes, analogue and digital electrical and electronic measurements. Household and industrial energy consumption measurements. Practical energy conservation principles.

GET 206: Fundamentals of Engineering Thermodynamics (3 Units C: LH 45)

Learning Outcomes

At the end of this course, the students should be able to:

1. describe basic concepts of thermodynamics, quantitative relations of Zeroth, first, second and third laws;

2. define and explain system, surrounding, closed and open system, control volume and control mass, extensive and intensive properties;
3. calculate absolute and gage pressure, and absolute temperature, calculate changes in kinetic, potential, enthalpy and internal energy;
4. evaluate the properties of pure substances i.e. evaluate the state of the pure substances such as compressed liquid, saturated liquid-vapour mixture and superheated vapour using property diagrams and tables; arrange the ideal and real gas equations of state,
5. formulate the first law of thermodynamics for a closed system i.e. organize the change in energy in the closed systems via heat and work transfer;
6. distinguish heat transfer by conduction, convection and radiation, and calculate the amount of heat energy transferred;
7. calculate the changes in moving boundary work, spring work, electrical work and shaft work in closed systems;
8. apply the first law of thermodynamics for closed systems and construct conservation of mass and energy equations;
9. formulate the first law of thermodynamics to the open systems i.e. describe steady-flow open system, apply the first law of thermodynamics to the nozzles, diffusers, turbines, compressors, throttling valves, mixing chambers, heat exchangers, pipe and duct flow;
10. construct energy and mass balance for unsteady-flow processes;
11. evaluate thermodynamic applications using second law of thermodynamics;
12. calculate thermal efficiency and coefficient of performance for heat engine, refrigerators and heat pumps; and
13. restate perpetual-motion machines, reversible and irreversible processes.

Course Contents

Basic concepts, definitions and laws (quantitative relations of Zeroth, first, second and third laws of thermodynamics). Properties of pure substances: the two-property rule (P-V-T behaviour of pure substances and perfect gases); state diagrams. The principle of corresponding state; compressibility relations; reduced pressure; reduced volume; temperature; pseudo-critical constants. The ideal gas: specific heat, polytropic processes. Ideal gas cycles; Carnot; thermodynamic cycles, turbines, steam and gas, refrigeration. The first law of thermodynamics – heat and work, applications to open and closed systems. The steady flow energy equation (Bernoulli's equation) and application. Second law of thermodynamics, heat cycles and efficiencies.

GET 208: Strength of Materials (3 Units C: LH 45)

Learning Outcomes

At the end of this course, the students should be able to:

1. recognise a structural system that is stable and in equilibrium;
2. determine the stress-strain relation for single and composite members based on Hooke's law;
3. estimate the stresses and strains in single and composite members due to temperature changes;
4. evaluate the distribution of shear forces and bending moments in beams with distributed and concentrated loads;
5. determine bending stresses and their use in identifying slopes and deflections in beams;
6. use Mohr's circle to evaluate the normal and shear stresses in a multi-dimensional stress system and transformation of these stresses into strains;

7. evaluate the stresses and strains due to torsion on circular members; and
8. determine the buckling loads of columns under various fixity conditions at the ends.

Course Contents
Consideration of equilibrium; composite members, stress-strain relation. Generalised Hooke's law. Stresses and strains due to loading and temperature changes. Torsion of circular members. Shear force, 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.

GET 210: Engineering Mathematics II (3 Units C: LH 45)
Learning Outcomes
At the end of the course, the students should be able to:
1. describe physical systems using ordinary differential equations (ODEs);
2. explain the practical importance of solving ODEs, solution methods, and analytically solve a wide range of ODEs, including linear constant coefficient types;
3. numerically solve differential equations using MATLAB and other emerging applications;
4. perform calculus operations on vector-valued functions, including derivatives, integrals, curvature, displacement, velocity, acceleration, and torsion, as well as on functions of several variables, including directional derivatives and multiple integrals;
5. solve problems using the fundamental theorem of line integrals, Green's theorem, the divergence theorem, and Stokes' theorem, and perform operations with complex numbers;
6. apply the concept and consequences of analyticity and the Cauchy-Riemann equations and of results on harmonic and entire functions of complex variables, as well as the theory of conformal mapping to solve problems from various fields of engineering; and
7. evaluate complex contour integrals directly and by the fundamental theorem, apply the Cauchy integral theorem in its various versions, and the Cauchy integral formula.

Course Contents
Introduction to ordinary differential equations (ODEs); theory, applications, methods of solution; second order differential equations. Advanced topics in calculus (vectors and vector-valued function, line integral, multiple integral and their applications). Elementary complex analysis including functions of complex variables, limits and continuity. Derivatives, differentiation rules and differentiation of integrals. Cauchy-Riemann equation, harmonic functions, basic theory of conformal mapping, transformation and mapping and its applications to engineering problems. Special functions.

UAES- MEE 212 Solar Energy Engineering (2 Units; C; LH =30; PH = 0)

Learning Outcomes
At the end of this course, the students should be capable of the following:
1. Describe the methods by which solar energy has been applied in times past;
2. explain various ways through which renewable energy can be sourced;
3. List and explain at least six environmental factors that affect the quality of solar energy;
4. describe the major devices used by engineers for sun's energy conversion; and

5. Explain the methods and workings of solar heating systems.

Course Contents
A brief History of Solar Energy. Photovoltaics. Solar Desalination. Solar Drying and Passive Solar Buildings. Other Renewable Energy Systems, including Wind, Biomass, Geothermal, Hydrogen, and Ocean Energy. Sun–Earth Geometric Relationship. Environmental Factors: Solar Radiation, Thermal, Transparent Plates, Extraterrestrial Radiation and Atmospheric Attenuation. Tilted Surfaces, and Solar Measuring Equipment. Solar Energy Collectors. Stationary Collectors. Sun-Tracking Concentrating Collectors. Thermal Analysis of Flat-Plate Collectors. Solar Heating Systems. Water heating systems. Air heating systems. Heat Storage Systems.

300 LEVEL (FIRST SEMESTER COURSE)

GET 301: Engineering Mathematics III (3 Units C: LH 45)

Learning Outcomes
At the end of the course, the students should be able to:
1. demonstrate a clear understanding of the course content, that is, possess a breadth of knowledge in the area covered;
2. possess an in-depth knowledge upon which a solid foundation can be built in order to demonstrate a depth of understanding in advanced mathematical topics;
3. develop simple algorithms and use computational proficiency;
4. write simple proofs for theorems and their applications; and
5. communicate the acquired mathematical knowledge effectively in speech, writing and collaborative groups.

Course Contents
Linear Algebra. Tensor algebra and analysis, Elements of Matrices, Determinants, Inverses of Matrices, bases representation of tensors. The Euclidean point space and vector spaces. Theory of Linear Equations. Eigen Values and Eigen Vectors. Analytical Geometry. Basic transformations: identity, spherical, Projection and Coordinate Transformation as tensors, Traces, Determinants and other scalar invariants. Equivalent stresses and strains as examples of scalar invariant. Applications to design, analyses and optimization. Elgenvalues, Elgeanvectors of tensors. 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 Integrals of Vectors. The gradient of scalar and fiels. Flux of Vectors. The curl of a vector field, Gauss, Greens and Stoke's theorems and applications: Determinations and applications to field equations in linear abd nonlinear mechanics. 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 305: Engineering Statistics and Data Analytics (3 Units C: LH 45)

Learning Outcomes
At the end of the course, the students should be able to:
1. work with data from the point of view of knowledge convergence, machine learning, and

intelligence augmentation, which significantly raises their standard for engineering analysis (the approach forces them to learn statistics in an actionable way that helps them to see the holistic importance of data analytics in modern engineering and technology);
2. anticipate the future with Artificial Intelligence while fulfilling the basic requirements of conventional engineering statistical programming consistent with their future careers;
3. perform, with proficiency, statistical inference tasks with language or programming toolboxes such as R, Python, Mathematica or MATLAB, and Design Expert to summarise analysis and interpretation of industry engineering data, and make appropriate conclusions based on such experimental and/or real-life industrial data;
4. construct appropriate graphical displays of data and highlight the roles of such displays in data analysis, particularly the use of statistical software packages;
5. plan and execute experimental programmes to determine the performance of programme-relevant industrial engineering systems, and evaluate the accuracy of the measurements undertaken; and
6. demonstrate mastery of data analytics and statistical concepts by communicating the results of experimental and industry-case investigations, critically reasoned scientific and professional analysis through written and oral presentation.

Course Contents

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, test hypothesis and significance. Regression and correlation. Introduction to big data analytics and cloud computing applications. Introduction to the R language; R as a calculator; Vectors, matrices, factors, data frames and other R collections. Iteration and looping control structures. Conditionals and other controls. Designing, using and extending functions. The Apply Family. Statistical modelling and inference in R.

GET 307: Introduction to Artificial Intelligence, Machine Learning and Convergent Technologies (3 Units C: LH 45)

Learning Outcomes

At the completion of the course, the students are expected to be able:
1. explain the meaning, purpose, scope, stages, applications and effects of artificial intelligence;
2. explain the fundamental concepts of machine learning, deep learning and convergent technologies;
3. demonstrate the difference between supervised, semi-supervised and unsupervised learning;
4. demonstrate proficiency in machine learning workflow and how to implement the steps effectively;
5. explain natural languages, knowledge representation, expert systems and pattern recognition;
6. describe distributed systems, data and information security and intelligent web technologies;
7. explain the concept of big data analytics, purpose of studying it, issues that can arise with a data set and the importance of properly preparing data prior to a machine learning exercise; and
8. explain the concepts, characteristics, models and benefits, key security and compliance

challenges of cloud computing.

Course Contents
Concepts of human and artificial intelligence; artificial/computational intelligence paradigms; search, logic and learning algorithms. Machine learning and nature-inspired algorithms – examples, their variants and applications to solving engineering problems; understanding natural languages; knowledge representation, knowledge elicitation, mathematical and logic foundations of AI; expert systems, automated reasoning and pattern recognition; distributed systems; data and information security; intelligent web technologies; convergent technologies – definition, significance and engineering applications. Neural networks and deep learning. Introduction to python AI libraries.

GET 399: Students Industrial Work Experience II (4 Units C: 12 weeks)

Learning Outcomes
At the end of the SIWES, students should be able to:
1. demonstrate proficiency in at least any three softwares in their chosen career choices;
2. demonstrate proficiency in some animation videos (some of which are free on YouTube) in their chosen careers;
3. carry out outdoor hands-on construction activities to sharpen their skills in their chosen careers;
4. demonstrate proficiency in generating data from laboratory analysis and develop empirical models;
5. demonstrate proficiency in how to write engineering reports from lab work;
6. fill logbooks of all experience gained in their chosen careers; and
7. write a general report at the end of the training.

The experience is to be graded and the students must pass all the modules of the attachment and shall form part of CGPA.

Course Contents
On-the-job experience in industry chosen for practical working experience but not necessarily limited to the student's major (Students are to proceed on three months of work experience i.e. 12 weeks during the long vacation following 300 level). Students are engaged in the more advanced workshops, indoor software design training similar to what they will use in the industry and outdoor construction activities to sharpen their skills. The use of relevant animation videos that mimic industrial scenarios is encouraged. Students are to write a report at the end of the training. As much as possible, students should be assisted and encouraged to secure 3 months placement in the industry. Examples of outline of activities and experiences to which students are expected to be exposed to earn prescribed credits include:

Section A: Welding and fabrication processes, automobile repairs, · lathe machine operations: machining and turning of simple machine elements, such as screw threads, bolts, gears, etc. Simple milling machine operations, machine tool maintenance and trouble-shooting, and wooden furniture making processes.

Section B: Mechanical design with computer graphics and CAD modelling and drafting. Introduction to Solidworks: software capabilities, design methodologies and applications.

Basics part modelling: sketching with SolidWorks, building 3D components, using extruded Bose base · Basic assembly modelling, and solidWorks drawing drafting. Top-down assembly technique exploded view, exploded line sketch. Introduction to PDMS 3D design software; autoCAD mechanical, SPSS.

A comprehensive case study design project. The student should be introduced to the concept of product/component design and innovation and then be given a comprehensive design project.

Examples of projects should include the following:

a. design of machine components;
b. product design and innovation;
c. part modelling and drafting in solidworks; and
d. technical report writing.

MEE 301: Computer-Aided Design and Manufacture (3 Units C: LH 30; PH 45)

Learning Outcomes
At the end of this course, the students should be able to:
1. visualise and apply basic drafting fundamentals;
2. prepare and edit engineering drawings;
3. explain the concepts and underlying theory of modelling and the usage of models in different engineering applications;
4. compare the different types of modelling techniques and explain the central role solid models play in the successful completion of CAD/CAM-based product development;
5. produce CAD drawings (create accurate and precise geometry of complex engineering systems and use the geometric models in different engineering applications);
6. use and assess commercial CAD/CAM tools efficiently, effectively and intelligently in selected engineering applications;
7. take active role in product design and development process as well as prototyping;
8. model 3D part and assemblies using SolidWorks program (or alternative CAD software);
9. analyse the part design using one of the computational methods (e.g. stress analysis) – calculate part features using math skills;
10. demonstrate proficiency in the concepts of computer-aided manufacturing and a number of applied associated processes; and
11. explain the basic concepts of CNC programming and machining.

Course Contents
Introduction to computer aided design (CAD)**.** Basic data structuring technique**.** Computer graphics**.** Geometric transformation techniques. Mathematical bases for surface modeling: curves, surfaces and solids**.** Principles of solid modeling and application**.** CAD software**.** Introduction to CAM: Relation between production volume and flexibility. Various manufacturing systems – batch, mass, group, cellular and flexible manufacturing systems. Type of automation and benefits of soft or flexible automation**.** Automation in material handling and assembly**.** CNC machines: Introduction, classification, design and control features including interpolations**.** Numerical control and NC part-programming**.** Introduction to Robotics: Definitions, motivation, historical development. Basic structure, classification, workspace, drives, controls, sensors, grippers, specifications. Manual CNC programming

(milling and turning)**.** Basic and advanced CAD/CAM for CNC (milling and turning)**.** Group project assignment.

UAES- GET 311 Engineering Economics (3 Units; C; LH =45; PH = 0)

Learning Outcomes

It is expected that at the end of this practical course, the students will be able to:

1) explain the concept of engineering economics;
2) discuss the flow of goods;
3) define services;
4) discuss resources and money payment system;
5) define the scope of engineering economics;
6) explain with examples microeconomic and macroeconomic;
7) clearly explain the method of determining the selling price of a product;
8) discuss the factors that influence demand and supply of commodities;
9) differentiate between technical efficiency and economic efficiency;
10) Determine depreciations;
11) Calculate taxes; and
12) Calculate present worth

Course Contents

The nature and scope of economics. Basic concepts of engineering economy. Economic analysis of engineering projects. Value systems economic decisions on capital investments. Choice of engineering alternatives. New projects. Replacements. Abandonment policies. Risky decisions. Corporate financial practices. Introduction to time value of money. Single payment discounting value. Elements of cost. Interest formulae. Discounted cash flow. Inflation. Resource depletion. Break-even analysis. Capital financing. Taxes and tax credits. Present worth. Equivalent annual growth, and rate of return comparisons. Replacement analysis. Depreciation. Make or buy decision. Breakdown analysis. Benefit-cost analysis. Minimum acceptable rate of return. Judging attractiveness of proposed investment.

UAES- MEE 307 Dynamic Systems and Vibration (3 Units; C; LH =30; PH = 45)

Learning Outcomes

On completion of the course, students should be able to:

1. Analyze the forces of mechanisms and balancing condition.
2. Explain free vibration of single degree of freedom systems;
3. Explain forced vibration of single degree of freedom systems.
4. Describe rigid body dynamics (kinematics) of linkages.
5. Explain the existing theory of mechanism.
6. Describe the concepts of mobility.
7. Describe the concepts of degrees of freedom,
8. Explain inertia.
9. Examine variety of mechanical engineering components.
10. Calculate forces in mechanisms.

11. Calculate accelerations in mechanisms.
12. Apply typical analytical techniques in dynamics.
13. Apply typical graphical techniques in dynamics.

.

Course Contents

Kinematics and kinetics of particles. Systems of particles with applications to central force motion. Impact and relative motion. Single-degree of freedom. Free and forced vibration. Forced vibration of single degree freedom system with damping. Dynamics of rigid bodies. Relative motion and gyroscopic motion. Structural dynamics and computer applications. Periodic motion. Non-harmonic periodic motion. Fourier analysis. Un-damped free vibration. Linear and torsion solution. Natural frequency of single degree freedom system. Bifilar suspensions. Trifler suspensions. Free vibrations with viscous damping of single degree freedom system and solution. Logarithmic decrement. Reciprocating and rotating unbalanced bodies in motion. Base excitation. Self-excited vibrations with examples. Balancing of several masses in different planes. Static and dynamic balancing. Balancing of rotating masses. Vibration isolation and transmissibility. Turning moment diagram & flywheel and their applications in engine & punching presses design.

UAES- MEE 309 Energy Management in Industry (2 Units; E; LH =30; PH = 0)

Learning Outcomes

At the end of this course, the students should be capable of the following:

1. describe the importance of energy management;
2. describe at least five forms of renewable energy;
3. outline at least seven instruments by which industrial energy can be measured;
4. name and describe five major energy facilities that are found within industries;
5. describe at least five major techniques used to conserve energy in industries; and
6. Explain the various methods for calculating the energy efficiency.

Course Contents

General Principles of Energy Management. Utility Plants and Renewable Sources for Factory Use. Forms of Renewable Energy. Solar. Wind. Hydraulic. Energy from Waste. Energy Measurement Techniques. Various groupings and description of instruments for Liquid. Gas and Vapor Measurements. Flow meters. Head meter. Pitot tube. Vortex. Electric Energy Flow Measurements and equipment. Temperature. Pressure and Other Measurements. Energy facilities. Boiler plants. Pumps and Fans. Air Compressors. Energy Storage Systems and Applicability in Industry. Hydro power and Applicability in Industry. Mechanical power and Applicability in Industry. Electric power and Applicability in Industry. Thermal power and Applicability in Industry. Calculation of the energy efficiency performance using various indexes such as energy use index, energy cost index and productivity metrics.

UAES- MEE 311 Reliability and Maintainability Engineering (3 Units; C; LH =45; PH = 0)

Learning Outcomes

On completion of the course, students should be able to:

1. Explain the maintenance function;

2. Describe the different types of maintenance;
3. Design maintenance systems;
4. Explain failure distributions;
5. State at least five failure analysis techniques;
6. Estimate components reliability;
7. Estimate systems reliability;
8. Explain systems maintainability;
9. Apply different methods of maintenance workload analysis;
10. State maintenance resources planning; and
11. Explain different methods for scheduling maintenance works.

Course Contents

Introduction to reliability and maintainability and reliability. Specification and metrics. Application to computer hardware system and communication equipment. Power systems and electronic components. Basic maintenance types. Procedures for computer and digital communication system. Fault troubleshooting techniques. Quality of Service (QoS) and time of availability of data communication. Quality control techniques. Design for higher reliability. Fault tolerance. Software Reliability. Software reliability specification and software reliability Metrics. Fault avoidance and fault tolerance. Programming for reliability and software safety and hazard analysis. Comparison of hardware and software reliability. Software for Quality and Assurance. Definition of software quality. Software quality factors. Quality control and cost of quality. Quality assurance activities . Formal technical reviews. Software quality metrics. Statistical quality assurance. ISO 9000 Requirements and Certification. ISO 9000-3 for software quality process. Process documentation and quality audit. Capability Maturity Model. Software Engineering Institute. Levels of maturity and key process areas. Comparison between ISO 9000 Standards and CMM. Quality and Reliability. verification and validation. Measurement tracking and feedback mechanism. Total quality management and risk management.

300 Level (Second Semester Course)

GST 312: Peace and Conflict Resolution (2 Units C: LH 30)

Learning Outcomes

At the end of this Course, students should be able to:

1. analyse the concepts of peace, conflict and security;
2. list major forms, types and root causes of conflict and violence;
3. differentiate between conflict and terrorism;
4. enumerate security and peace building strategies; and
5. describe the roles of international organisations, media and traditional institutions in peace building.

Course Contents

The concepts of peace, conflict and security in a multi-ethnic nation. Types and theories of conflicts: ethnic, religious, economic, geo-political Conflicts; structural conflict theory, realist theory of conflict, frustration-aggression conflict theory; root causes of conflict and violence

in Africa: indigene and settlers phenomenon, boundaries/boarder disputes, political disputes, ethnic disputes and rivalries, economic inequalities, social disputes, nationalist movements and agitations; selected conflict case studies – Tiv-Junkun, ZangoKartaf, chieftaincy and land disputes, etc. Peace building, management of conflicts and security: Peace & Human Development. Approaches to Peace & Conflict Management (religious, government, community leaders, etc.). Elements of peace studies and conflict resolution: Conflict dynamics assessment Scales: Constructive & Destructive. Justice and Legal framework: Concepts of Social Justice; The Nigeria Legal System. Insurgency and terrorism. Peace mediation and peace keeping. Peace and Security Council (international, national and local levels). Agents of conflict resolution – Conventions, Treaties Community Policing: Evolution and Imperatives. Alternative Dispute Resolution (ADR) (dialogue,. arbitration, negotiation, collaboration, etc). The roles of international organizations in conflict resolution ((a) The United Nations, UN and its conflict resolution organs. (b) The African Union & Peace Security Council (c) ECOWAS in peace keeping). The media and traditional institutions in peace building. Managing post-conflict situations/crises: Refugees. Internally Displaced Persons (IDPs);the role of NGOs in post-conflict situations/crises.

ENT 312: Venture Creation (2 Units C: LH 15; PH 45)

Learning Outcomes

At the end of this course, students, through case study and practical approaches, should be able to:

1. describe the key steps in venture creation;
2. spot opportunities in problems and in high potential sectors, regardless of geographical location;
3. state how original products, ideas and concepts are developed;
4. develop a business concept for further incubation or pitching for funding;
5. identify key sources of entrepreneurial finance;
6. implement the requirements for establishing and managing micro and small enterprises;
7. conduct entrepreneurial marketing and e-commerce;
8. apply a wide variety of emerging technological solutions to entrepreneurship; and
9. appreciate why ventures fail due to lack of planning and poor implementation.

Course Contents

Opportunity identification (sources of business opportunities in Nigeria, environmental scanning, demand and supply gap/unmet needs/market gaps/market research, unutilised resources, social and climate conditions and technology adoption gap). New business development (business planning, market research). Entrepreneurial finance (venture capital, equity finance, micro-finance, personal savings, small business investment organizations and business plan competition). Entrepreneurial marketing and e-commerce (principles of marketing, customer acquisition & retention, B2B, C2C and B2C models of e-commerce, First Mover Advantage, E-commerce business models and successful e-commerce companies). Small business management/family business: Leadership & Management, basic book keeping, nature of family business and family business growth model. Negotiation and business communication (strategy and tactics of negotiation/bargaining, traditional and modern business communication methods). Opportunity discovery demonstrations (business idea generation presentations, business idea contest, brainstorming sessions, idea pitching). Technological solutions (The concept of market/customer solution, customer solution and emerging technologies, business applications of new technologies - artificial intelligence

(AI), virtual/mixed reality (VR), Internet of things (IoTs), blockchain, cloud computing, renewable energy, etc. Digital business and e-commerce strategies).

GET 302: Engineering Mathematics IV (3 Units E: LH 45)

Learning Outcomes

At the end of the course, the students should be able to:

1. solve second order differential equations;
2. solve partial differential equations;
3. solve linear integral equations;
4. relate integral transforms to solution of differential and integral equations;
5. explain and apply interpolation formulas; and
6. apply Runge-Kutta and other similar methods in solving ODE and PDEs.

Course Contents

Series solution of second order linear differential equations with variable coefficients. Bessel and Legendre equations. Equations with variable coefficients. Sturn-Louville 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, Mellin and Handel Transforms. Convolution integrals and Hilbert Transforms. Calculus of finite differences. Interpolation formulae. Finite difference equations. RungeKutta and other methods in the solutions of ODE and PDEs. Numerical integration and differentiation.

GET 304: Technical Writing and Communication (3 Units C: LH 45)

Learning Outcomes

At the end of the course, the student should be able to:

1. demonstrate the concept of clear writing, common pitfalls and unambiguous language in engineering communication, including technical reporting for different applications and emotional comportment;
2. demonstrate the skills of language flexibility, formatting, logic, data presentation styles,
3. demonstrate good interpersonal communication skills through hands-on and constant practice on real-life communication issues for engineers in different sociocultural milieu for engineering designs, structural failure scenarios and presentation of reports.

Course Contents

A brief review of common pitfalls in writing. Principles of clear writing (punctuations and capitalization). Figures of speech. Units of grammar. Tenses and verb agreement. Active and passive sentences Lexis and structure Fog Index concept. Skills for communication and communication algorithm. Types and goals of communication; Interpersonal communication; features and the Finger Model or A,B,C,D,E of good interpersonal communication (accuracy of technical terms, brevity of expression, clarity of purpose, directness of focus and effectiveness of the report). Language and organisation of reports. Technical report writing skills(steps, problems in writing, distinguishing technical and other reports, significance, format and styles of writing technical reports). Different formats for communication; styles of correspondences – business report and proposal, business letter, memorandum, e-mails, etc. Proposals for projects and research; format, major steps and tips of grant-oriented proposals. Research reports(competency, major steps, components and formats of research reports and publishable communication). Sources and handling of data, tables, figures, equations and references in a report. Presentation skills; overview, tips, organisation, use of visual aids and

practising of presentation. Intellectual property rights in research reports. Case studies of major engineering designs, proposals and industrial failures with professional presentation of reports.

GET 306: Renewable Energy System and Technology (3 Units C: LH 30 PH 45)

Learning Outcomes

At the end of the course, the students should be able to:

1. identify the types, uses and advantages of renewable energy in relation to climate change;
2. design for use the various renewable energy systems;
3. recognise and analyse the current energy systems in Nigeria, their impacts on development and the global energy demand and supply scenarios;
4. appreciate the environmental impact of energy exploitation and utilisation, and pursue the sustainable development of renewable energy for various applications; and
5. recognise the exploitation, excavation, production, and processing of fossil fuels such as coal, petroleum and natural gas, and discuss the sources, technology and contribution to future energy demands of renewable energy.

Course Contents

Current and potential future energy systems in Nigeria and globally - resources, extraction, concepts in energy conversion systems; parallels and differences in various conversion systems and end-use technologies, with emphasis on meeting 21st-century national, regional and global energy needs in a sustainable manner. Various energy technologies in each fuel cycle stage for fossil (oil, gas, synthetic), nuclear (fission and fusion) and renewable (solar, biomass, wind, hydro, and geothermal). Energy types, storage, transmission and conservation. Analysis of energy mixes within an engineering, economic and social context. Sustainable energy; emphasise sustainability in general and in the overall concept of sustainable development and the link this has with sustainable energy as the fundamental benefit of renewable energy.

Practical Content: Simple measurement of solar radiation, bomb calorimeter determination of calorific value of fuels and biomass; measurement of the velocity of wind, waves and the energy that abound in them; laboratory production of biogas and determination of energy available in it; simple conversion of solar energy to electricity; transesterification of edible oil into biodiesel; simulation of geothermal energy; Geiger-Muller or Scintillation Counters' determination of uranium or thorium energy; simple solid or salt storage of energy; hybrid application of renewable energy.

UAES- MEE 314 Plasticity (2 Units; Elective; LH = 30; PH = 0)

Learning Outcomes

On completion of the course, students should be able to:

1. calculate plasticity ranges for different materials/bodies;
2. evaluate stresses and strains due to torsion on circular members;
3. apply resolution methods on elastoplastic problems;
4. estimate application range;
5. apply the resolution methods to classical problems of plasticity;
6. analyze problems of bending of beams; and
7. Analyze new Stress and strain related problems.

Course Contents
Fundamentals of plasticity. Elasticity. Stress and strain relations. Yield criteria. Various approximate methods applied to elastoplastic problems of bending of beams and torsion and bars. Plastic limit design. Plastic Deformation. Elastic-plastic solid. Theory of plasticity. Rigid-plastic solid (Lévy – Mises model). Ideally plastic model. Type of load and deformation. Range of elastic deformation. Plastic yielding ("plastic flow"). Hardening. Offset yield stress. Mechanisms of Plastic Deformation. Elastic Unloading. Incompressibility, Pressure Independence. Induced Anisotropy.

UAES- MEE 308 Introduction to Automotive and Autotronics Engineering (3 Units; C; LH = 30; PH = 45)

Learning Outcomes
On completion of the course, students should be able to:

1. Identify types vehicular chassis.
2. Identify types associated components/systems.
3. State types of steering system.
4. Identify materials available for automotive parts manufacture.
5. Select accurately the right materials for automotive design and construction.
6. Examine the aerodynamic stability of vehicle during use.
7. Examine ergonomics and vehicle stability.
8. Troubleshoot and maintain different vehicular system.
9. Produce indigenous cars/vehicles using available materials.

Course Contents
Definition of automotive engineering. History of automotive engineering. The role of automotive engine and in transportation industry. Automotive engine and components maintenance. Employment areas for automotive engineers. Internal combustion engines and their efficiency and pollutants emission. The emerging power technologies in the automotive industry. Current and alternative fuels and combustion processes. Choice of fuel and design of efficient engine. Operating parameters of engine design and their by-products. Examination of different materials used in the automotive industry including metals and ceramics and composites. Selection of appropriate material for a variety of applications in the manufacture of automotive systems in anticipated service environment. Automotive vehicle dynamics and safety. Dynamics of vehicles on the road during normal operation as well as during impact. Vehicle handling and stability control. Tyre dynamics and suspension design. Braking performance and automotive safety. Impact dynamics and road safety regulations. Checks on spark plugs and injectors and air filters and water level and engine oil level and engine oil viscosity and air filter and transmission fluid level and coolant water level. Checks on tire gauge and wear and wheel balancing and exhaust catalytic system and pipe and holes damage. Engine load Sensors and Speed and Position Sensors and Temperature Sensors and O2- Sensors and Knock Sensors. Actuators. Relays and static switches. Ignition actuators. Cold start control. Display devices. Auxiliary electron. Dynamics of crank gear. Balancing of engines. Autotronics diagnostics using OBD II/ scan tools. Maintenance and repair of engine systems.

UAES- MEE 310 Tribology-Mechanical Interface Design (2 Units; E; LH =30; PH = 0)

Learning Outcomes

At the end of this course, the students should be capable of the following:

1. explain the concept of tribology;
2. describe at least six machine design problems attributed tribology;
3. explain the principle of tribology;
4. state five ways tribology relates to contact surfaces;
5. describe tear and wear;
6. state at least six different forms of tear and wear;
7. describe lubrication;
8. explain the mechanism of kinematic pairs;
9. describe tribo-design aspect of mechanical seals.

Course Contents

Introduction to the concept of tribodesign. Specific Tribological problems in machine design such as Plain sliding bearings. Rolling contact bearings. Basic principles of tribology. friction types. Sliding friction. Ploughing friction. Types of wear. Abrasive wear. Surface fatigue wear. Chemical reactions. Film lubrication. Coefficient of viscosity. Fluid film. Viscous flow between parallel surfaces. Shear stress variations within the film. The Osborne Reynolds. Lubrication theory. Elements of contact mechanics. Concentrated and distributed forces on plane surfaces. Failures of contacting surfaces. Contact between rough surfaces. Lubrication and wear in lower kinematic pairs. Friction angle. Rim clutch - mechanism and operation. Centrifugal clutch - mechanism and operation. Frictional aspects of break design, drives utilization friction force, Pneumatic tires. Mechanical seals. the use of surface tension. Viscosity. Hydrodynamic action in design. Wear in seals.

400 LEVEL (FIRST SEMESTER COURSE)

GET 499: Students Industrial Work Experience III (8 Units C: 24 weeks)

Learning Outcomes

Students on Industrial Work Experience Scheme (SIWES) are expected to:

1. be exposed and prepared for the Industrial work situation they are likely to meet after graduation, by developing their occupational competencies;
2. bridge the existing gap between theory and practice of programmes through exposure to real-life situations, including machines and equipment handling, professional work methods and ethics, human relations, key performance assessment methods, and ways of safeguarding the work environment – human and materials;
3. experience/simulate the transition phase of students from school to the world of work and the environment seamlessly, and expose them to contacts for eventual job placements after graduation;
4. be motivated to identify the industrial and practice engineering challenges of their place of engagement and the larger society and creatively device impactful solutions to them; and
5. exploit the opportunity to improve and utilise their acquired critical thinking and innate creativity skills, during the program and SIWES Seminar presentation respectively.

Course Contents
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 the first semester at 400-Level to the beginning of the first semester of the following session. Thus, the second semester at 400-Level is spent in industry). Each student is expected to work in a programme related industry, research institute or regulatory agencies etc, for a period of 6 months under the guidance of an appropriate personnel in the establishment but supervised by an academic staff of the Department. On completion of the training, the student submits the completed Log book on the experience at the establishment., Also, there will be a comprehensive report covering the whole of the student's industrial training experiences (GET 299, GET 399 and GET 499), on which a seminar will be presented to the Department for overall assessment.

MEE 401: Mechanical (Machine) Engineering Design II (3 Units C: LH 45)

Leaning Outcomes
At the end of this course, the students should be able to:
1. demonstrate proficiency in the principles of design;
2. demonstrate proficiency in the selection of materials for design;
3. carry out simple stress analysis; and
4. demonstrate proficiency in principles of coupling, clutches and brakes.

Course Contents
Journal bearings. Application of Hertz stress theory. Fluid couplings. Lubrication mechanics: hydrodynamic theory applied to tapered wedge and journal bearings and hydrostatic lubrication applied to journal bearings. Gears and power transmission systems. Elements of fluid power system design. Design of cylinders, pipes and pipe joints, tubes, plates and flywheel. Seals, packaging, gaskets and shields. 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 D.

MEE 402 Theory (Mechanics) of Machines II (2 Units C: LH 30)

Leaning Outcomes
At the end of this course, the students should be able to:
1. identify the forces acting on a mechanism and the resolution of the forces;
2. demonstrate understanding of the performance of various mechanisms and principal machine elements as regards their kinematics and dynamics;
3. identify the types of motion and their applications;
4. identify forces on shaft and bearing due to single revolving mass;
5. demonstrate procedure for balancing several masses in different transverse planes;
6. prepare professional quality solutions and presentations to effectively communicate the results of analysis and design;
7. translate ideas and imaginations into conceptual designs using the tools of conventional engineering drawings and computer aided designs; and
8. use the knowledge of the course

Course Contents
Force analysis of mechanisms, fluctuation of kinetic energy and inertial effects. Complete static and dynamic analysis. Flexible shaft couplings: belt, rope and chain drives. The flywheel and mechanical governors. Brakes and dynamometers. Balancing of multi-cylinder engines. Balancing of machinery. Vibration of machinery; free and forced vibration, damping, natural frequencies and critical speeds. Transverse vibrations of beams, whirling of shafts and torsional vibrations.

MEE 403: Applied Engineering Thermodynamics (2 Units E: LH 30)

Learning Outcomes
At the end of this course, the students should be able to:
1. apply the knowledge of mathematics, science and engineering fundamentals to model the energy conversion phenomenon;
2. identify fuel types, availability, utilisation and its conversion to energy, understand fuel chemistry, combustion analysis, develop combustion equations and conduct exhaust and flue gas analysis in the laboratory;
3. identify enthalpy changes, determine heating values of fuels, steam generators;
4. identify type of boilers, fuels and combustion controls in boilers and power plant efficiency;
5. perform air standard cycle analysis, refrigeration and heat pump cycles and demonstrate their various application in internal combustion engines/refrigeration systems;
6. demonstrate proficiency in energy analysis, fuel combustion and thermal systems design; and
7. provide solution to thermodynamic problems in HVAC systems, power plant, engines or renewable energy technology.

Course Contents
Multistage reciprocating compressors. Rotary compressors – centrifugal and axial-flow; stagnation properties. Simple gas turbine plant. The steam power plant. Combustion of fuels; chemistry of common hydrocarbon fuels, combustion with deficiency or excess air. Thermo-chemistry: Hess' Law of Heat Summation; heats of combustion and reaction; ideal adiabatic flame temperature. Reciprocating internal combustion engines. General thermodynamics relations. Kinetic theory of gas. Mixture of gases, psychometry, air-conditioning and cooling towers. Introduction to heat transfer.

MEE 404: Applied Fluid Mechanics (2 Units E: LH 30)

Learning Outcomes
At the end of this course, the students should be able to:
1. identify the various types of fluids and flows;
2. carry out simple calculations on floating and submerged surfaces;
3. explain the concept of fluid machinery for prototype development;
4. explain concepts of boundary layer;
5. explain and derive the Navier–Stokes equation for conservation of momentum and conservation of mass for Newtonian fluids;
6. describe machines that transfer energy between a rotors and a fluids;
7. identify pump types performed by simple pump selection, including both turbines and compressors; and

8. perform simple CDD grid processing, calculations and result processing.

Course Contents

Unsteady flow; oscillation in U-tube; surge tank; water hammer. Open-channel flows. Introductory concepts of boundary layer and re-circulating flows, mathematical derivation of Navier-stokes equations and its application. Dimensional analysis and similitude. Introduction to turbo machinery; characteristic curve for axial-flow and centrifugal pumps, fans, blowers, impulse and reaction turbines. Pump selection and application. Pipeline systems (Series and Parallel). Open channel flow. Overview of computational fluid dynamics (CFD).

MEE 405: Heat and Mass Transfer II (3 Units C: LH 45)

Learning Outcomes

At the end of this course, the students should be able to:

1. explain the principle of heat by diffusion under steady or unsteady conditions;
2. explain continuity and momentum equations and their roles in convection heat transfer analysis;
3. recognise convection heat transfer in laminar and turbulent flows;
4. determine heat transfer coefficients in internal and external flows;
5. identify dimensionless groups in convection heat transfer;
6. identify combined modes of heat transfer;
7. perform simple heat exchanger analysis and design;
8. demonstrate an understanding of heat and mass transfer modes and models;
9. demonstrate understanding of the different types of interface reactions;
10. explain comparison of Fick's and Fourier's laws and similarities between conduction and mass transfer in stationary systems; and
11. apply principles of heat and mass transfer phenomena to selected processes.

Course Contents

Convection heat transfer: Newton's law of cooling. Energy equation of convection. Continuity and momentum equations and their roles in convection heat transfer analysis. Convection heat transfer in laminar and turbulent flows. Internal and external flows. Heat transfer coefficients. Dimensional analysis and dimensionless groups in convection heat transfer. Convection heat transfer correlations. Heat exchanger analysis and design. Combined modes of heat transfer.

Mass transfer: Mechanisms of mass transfer. Fick's law of mass diffusion. General diffusion law. Rate equations. Comparison of Fick's and Fourier's laws. Equations of mass transfer in stationary systems. Similarities between conduction and mass transfer in stationary systems. Mass transfer coefficient. Electrical analogy of mass transfer. Equimolal counter diffusion. Drying and humidification of solids and gases. Types of dryers. Evaporation. Mass transfer correlations in convective systems.

MEE 406: Advanced Mechanics of Materials (2 Units C:LH 30)

Learning Outcomes

At the end of this course, the students should be able to:

1. explain the theory, concepts, principles and governing equations of solid mechanics;
2. demonstrate the ability to deconstruct complex problems to produce effective outcomes;
3. perform simple analysis on thick cylinders; compound cylinders, rotating disks and

bending of flat plates;
4. perform simple analysis on beams on an elastic foundation;
5. explain two-dimensional theory of elasticity and apply to elastoplastic problems;
6. use analytical, experimental and computational tools needed to solve the idealised problem;
7. Use these solutions to guide a corresponding design, manufacture, or failure analysis;
8. explain the selection, design and stress analysis of composite materials;
9. analyse the stresses in simple structures as used in industry, and
10. use interpersonal understanding, teamwork and communication skills working on group assignments.

Course Contents

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 problems and limit theory.

UAES- MEE 406 Introduction to Mechatronics (3 Units; C; LH =30; PH = 45)

Learning Outcomes

This course is designed in such a way that graduate students will be able to:

1) describe the basic concept of mechatronics;
2) develop the mathematical model of the physical systems;
3) analyze the responses of closed and open loop systems;
4) analyze the stability of closed and open loop systems;
5) describe the working principles of basic industrial automation systems;
6) demonstrate proficiency in automation;
7) explain numerical control system;
8) explain networking of field devices; and
9) Develop system integration.

Course Contents

Mechanical components and motion systems. Control systems. Power and driving systems. Solenoid and robust sensing. Actuators. Numerical control. Event-driven programming. Modeling and simulation. System integration. Introduction of robotics. Fundamentals of kinematics and dynamics. Industrial automation and control. Microcontroller and embedded systems. Robotic Systems. Discrete and continuous variable control systems. Industrial communication and embedded computing. Networking of field devices. Translation and rotation. Denvavit-Hartenberg parameters. Forward and inverse kinematics. Jacobian. Dynamics. Equations of motion. Newton-Euler formation. Sensors and actuators. Strain gauge. Resistive potentiometers. Tactile and force sensors. Tachometers. LVDT and Piezo electric accelerometer. Hall Effect sensors. Optical encoders. Pneumatic actuators. Hydraulic actuators. Servo valves. DC motor, stepper motor, and drives. Control of manipulators. Feedback control of 2^{nd} order linear systems. Joint control. Trajectory control, controllers. PID control.

UAES- MEE 407 Fracture of Structural Materials (3 Units; E; LH =45; PH = 0)

Learning Outcomes

Upon completion of the course, students should be able to:

1. apply correctly fracture mechanics to predict brittle fracture;
2. identify and describe the basic fractures of fatigue mechanisms;
3. explain crack resistance
4. describe energy release rate for crack criticality;
5. apply linear elastic fracture mechanics on brittle materials;
6. identify plane stress and plane strain conditions;
7. identify the causes of failure in materials;
8. determine the relationship between crack tip and opening displacement;
9. use experimental techniques to determine the critical values of parameters at crack tip; and
10. Describe wester guard approach for different modes of fracture.

Course Contents

Stress-strain curve. Elements of dislocation theory. Stress concentration effect of flaws. Fracture mechanics approach to design. Effect of material properties on fracture. Cleavage. Brittle. Buctile fracture. Ductile brittle transition. Modes of fracture failure. Fatigue and stress corrosion cack growth. Damage tolerance. An atomic view of fracture. Griffith energy balance. Energy release rate. Instability and the R Curves. Compliance. Tearing modulus. Stress and displacement field in isotropic elastic materials. Airy stress function. Westergard approach for different modes of fracture. Stress analysis of crack. Stress intensity factor (SIF). Relation between K and global behaviour. Effect of finite size. Crack tip deformation and plastic zone size. Plane stress vs plane strain. Effective crack length. Irwin plastic zone correction. Dugdale approach. Effect of plate.

UAES- MEE 408 Theory of Elasticity (3 Units; C; LH =30; PH = 45)

Learning Outcomes

At the end of this course, the students should be capable of the following:

1. define elasticity;
2. state the significance of elasticity in machine design;
3. describe at least five basic concepts of the theory of elasticity;
4. explain the mathematical relationships for stress and strain at a point;
5. describe the theory of plasticity;
6. describe basic mechanisms of plastic deformation in single crystals;
7. explain dislocation theory;
8. state dislocation theory;
9. apply plastic stress-strain relations to solve real life problems; and
10. Use flow curves in practical applications.

Course Contents

Introduction to the concept of elasticity. Elastic and plastic behavior. Tensile deformation of ductile metal. Ductile vs. Brittle Behavior. What Constitutes Failure. Components of stress.

Components of strain. Hooke's law. Stress at a point. Strain at a point. Measurement of surface strains. Introduction to Plasticity. The flow curves. True stress and true strain. Yielding criteria for ductile metals. Plastic Stress-Strain Relations. Introduction to dislocation. Observation of dislocations. Burgers Vector and the dislocation loop. Dislocations in the face-centered cubic lattice. Surface and body forces. Stress tensor and transformation laws. Lagrangian and Eulerian description. Strain tensor. Equations of elasticity and and equilibrium and constitutive law and compatibility and boundary conditions. Uniqueness and St. Venant's principle. Strain energy functions. Two-dimensional problems in rectangular coordinates. Polynomial solution. Bending of beam. Fourier series solution. Two-dimensional problems in polar coordinates. axisymmetric problems – rotating discs. Walled cylinders, plate with a hole. Infinite plate with point load, curved beams. Two-dimensional problems in curvilnear coordinates. Stress functions in terms of harmonic and complex functions. Complex potential function. Elliptic coordinates. Plate with elliptic holes.

UAES- MEE 409 Fluid Dynamics (3 Units; C; LH =45; PH = 0)

Learning Outcomes

At the end of this course, the students should be capable of the following:

1. describe four key fluid properties that are used in the analysis of fluid behavior;
2. explain concepts of surface tension;
3. explain the procedure for determination of pressure at various locations in a fluid at rest;
4. describe four flow characteristics based on velocity field;
5. describe various methods of applying Newton's second law to fluid flows;
6. describe the development of the Bernoulli equation;
7. state three differences between the Eulerian and Lagrangian descriptions of fluid motion; and
8. Apply stagnation theory in solving practical problems.

Course Contents

Introduction to fluid dynamics. Characteristics of Fluids. Dimensions and Units. Analysis of Fluid Behavior. Measures of Fluid Mass and Weight. Compressibility of Fluids. Vapor Pressure. Surface Tension. Pressure at a Point. Basic Equation for Pressure Field. Pressure Variation in a Fluid at Rest. Measurement of Pressure. Hydrostatic Force on a Plane Surface. Buoyancy. Flotation. Stability. Pressure Variation in a Fluid with Rigid-Body Motion. Newton's Second Law. Static. Stagnation. Dynamic. Total Pressure. Use of the Bernoulli Equation. The Energy Line and the Hydraulic Grade Line. The Velocity Field. Eulerian Flow Descriptions. Lagrangian Flow Descriptions.

500 LEVEL (FIRST SEMESTER COURSE)

GET 501: Engineering Project Management (3 Units C: LH 45)

Learning Outcomes

At the end of the course, students should be able to:

1. explain the basics of project management as it relates to the Engineering discipline;
2. demonstrate knowledge and understanding of engineering, management and financial principles and apply these to their own work, as a member and/or leader in a team, to manage projects and in multi-disciplinary environments;
3. conduct, manage and execute projects in multi-disciplinary areas;

4. possess the skills needed for project management; and
5. work within the budget when executing a project for proper management.

Course Contents
Project management fundamentals – definitions, project environment, nature and characteristics, development practice, management by objectives, and the centrality of engineering to projects, infrastructures, national and global development. The scope of project management – organisational, financial, planning and control, personnel management, labour and public relations, wages and salary administration and resource management. Identification of project stakeholders; beneficiaries and impacted persons – functions, roles, responsibilities. Project community relations, communication and change management. Project planning, control and timeliness;decision making, forecasting, scheduling, work breakdown structure (WBS), deliverables and timelines, logical frameworks (log frames), risk analysis, role of subject matter experts (SMEs), role conflicts; Gantt Chart, CPM and PERT. Optimisation, linear programming as an aid to decision making, transport and materials handling. Monitoring and Evaluation – key performance indices (KPIs); methods of economic and technical evaluation. Industrial psychology, ergonomics/human factors and environmental impact considerations in engineering project design and management. Project business case - financial, technical and sustainability considerations. Case studies, site visits and invited industry professional seminars. General principles of management and appraisal techniques. Breakthrough and control management theory; production and maintenance management. Training and manpower development. The manager and policy formulation, objective setting, planning, organising and controlling, motivation and appraisal of results.

MEE 503: Applied Design (3 Units C: LH 45)

Learning Outcomes
At the end of this course, the students should be able to:
1. demonstrate proficiency in systematic scientific design methodology;
2. demonstrate creative application of the design process to engineering problems;
3. demonstrate proficiency in design for the manufacture of complete mechanical systems and devices;
4. undertake a group design project;
5. submit reports showing all calculations, justification for choice of design and instructions on detail design, manufacture, testing and use; and
6. demonstrate use and evaluation of a CAD/CAM software package in the actual manufacturing design project.

Course Contents
Scientific Design Methodology: creative application of the design process to engineering problems with emphasis on the manufacture of complete systems to accomplish overall objectives of minimum weight, high efficiency while satisfying the design constraints. An appreciation of the process of engineering design, and of systematic procedures and tools usable in the design process, with particular reference to mechanical systems and devices. Topics include systematic problem definition, search for possible solutions, statistical analysis of stress/strength interference, experiment planning techniques, optimum design for minimum weight and cost, and management of the design process. Design Project: Students will be required to conduct a design project under supervision, using the presented techniques, and taking at least to a workable layout drawing of a device. The design should involve simple mechanical systems (e.g. testing and assembling devices, heat drive, etc.) for a

specified duty, analyse its operating conditions and after considering the design criteria, choose between potential solutions. Reports submitted by students should contain all calculations, a comparison of potential solutions, justification for the design finally chosen, and instructions on detail design, manufacture, testing and use. 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 509: Project **(6 Units C:L H/PH 270)**

Learning Outcomes

At the end of this course, the students should be able to:

1. identify an engineering research problem;
2. demonstrate proficiency in PowerPoint presentation in a seminar;
3. demonstrate a methodology for actualising aims and objectives of a research project;
4. partake in a group research project efficiently; and
5. submit report comprising a topic, abstract, problem statement, aims and objectives, methodology, experimentation and/or analysis, results and analysis, conclusion and recommendation.

Course Contents

Final-year projects are assigned at the beginning of each academic year. Each final year student chooses a project supervisor in consultation with the final-year project coordinator. The process is entirely interactive, but the coordinator ensures that there is an even distribution of students amongst the lecturers. The final topic is decided by the student and his supervisor, selected from the fields of mechanics of solids and fluids, materials science, machine design, heat power, heat transfer, production technology, industrial engineering and management. Each student presents at least two seminars as part of their final year project, usually at the beginning and ending of the second semester. Each student is required to submit a report of their findings and undergo an oral examination. All seminars are scored by a panel of lecturers.

UAES- MEE 503 Cost Engineering **(2 Units; E; LH = 30; PH = 0)**

Learning Outcomes

At the end of the course, the students should be able to:

1) explain cost estimation;
2) interpret cost engineering report;
3) State at least two roles of a cost engineer in an organization;
4) list the resources used for cost engineering;
5) explain activity allowances and contingency;
6) describe the relationship between cost estimation and cost control;
7) list the types of cost; and
8) State the various stages of a project.

Course Contents

Cost and schedule management. 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. **Decisions and Risks and Uncertainties. Data Analysis and Presentations. Cost Report and communication. Cost control and Planning. Investment appraisal.** Introduction to digitalization of cost engineering Module. **Cost management.** Project Control.

UAES- MEE 513 Manufacturing Technology (2 Units; C; LH =30; PH = 0)

Learning Outcomes
Upon completion of the course, students should be able to:

1. identify the different stages of a manufacturing process;
2. interpret the elements of the product design process;
3. identify the common machines used in a manufacturing process;
4. explain the operations of machines used in manufacturing;
5. determine the operations used in finishing manufactured products;
6. explain the operations of automated machines used in manufacturing;
7. interpret the functionality of base lining;
8. describe documentations in a manufacturing process;
9. determine the main elements of quality assurance in a process; and
10. Identify characteristics of end product logistics.

Course Contents
Product concepts. Market feasibility and engineering design. Prototyping. Production. Marketing/sales. Manufacturing design. Product analysis. Materials. Costs. Production methods and assembly lines. Work cells. Inventory. Workflow. Quality control. Production monitoring. Product testing. Production processes. Machine and process overviews. Drilling. Boring and machining. Presses. Moulding and casting. Welding. Finishing. Assembly. Materials. Applicable types. Costs. Availability. Production machine operations. Presses. Advanced intelligence automation. Programmable logic controllers. Baselines. Environmental control. Quality improvement. Production improvement. Finished product logistics. Delivery methods. Delivery options. Customer interaction.

UAES- MEE 515 Engineering Design Process (2 Units; C; LH =30; PH = 0)
Learning Outcomes
At the end of this course, the students should be capable of the following:

1. define engineering design;
2. describe the need for a systematic design process;
3. describe the five steps for the design process;
4. identify four essential skills that are prerequisite to the design process;
5. conduct market surveys;
6. conduct market analysis for their product development;
7. explain project requirements from the needs statement;
8. state project prioritization requirements according to order of importance; and
9. discuss the essentials of function analysis.

Course Contents

Definition of engineering design. Basic systemic design. Working in teams. Scheduling. Research skills. Technical writing and presentation. Problem definition and statement of need. Information gathering clarifying the need. How to conduct a market analysis. Information resources. Identifying customer requirements. Prioritizing customer requirements. Organizing customer requirements. Objective tree. Function decomposition and structure. Procedure to establish functional structures. Reverse engineering. Specifications. Performance-specification method.

500 LEVEL (SECOND SEMESTER COURSE)

GET 502: Engineering Law (2 Units C: LH 30)

Learning Outcomes

Students will be able to:

1. describe and explain the basic concept, sources and aspects of law;
2. describe and explain the major differences between the various categories of law, courts and legal jurisdictions;
3. describe and explain legal principles and their application in professional engineering design and management services and their professional liability implications; and
4. develop reasoned analysis of real-life or hypothetical engineering scenarios using the legal principles undertake critical analysis of reliable information to develop, and practically present technical reports for use in varying judicial/quasi-judicial settings including as an expert witness.

Course Contents

Common Law: its history, definition, nature and division. Legislation, codification interpretation. Equity: definition and its main spheres. Law of contracts for Engineers: Forms of contract and criteria for selecting contractors; offer, acceptance, communication termination of contract. Terms of Contracts; suppliers' duties – Damages and other Remedies. Termination/cancellation of contract Liquidation and Penalties; exemption clauses, safety and risk. Health and Safety. Duties of employers towards their employees. Duties imposed on employees. Fire precautions act. Design for safety. General principles of criminal law. Law of torts: definition, classification and liabilities. Patents: requirements, application, and infringement. Registered designs: application, requirements, types and infringement. Company law. Labour law and Industrial Law. Business registration.

UAES- MEE 504 Control Systems (3 Units; C; LH =45; PH = 0)

Learning Outcomes

At the end of the course, the students should be able to:

1) state the basic components;
2) state the types of a control system
3) use Mason's gain formula to calculate the overall gain of a control system;
4) describe the concept of damping and steady state errors in transient response;
5) use Routh-Hurwitz's (R-H) criteria to determine the stability of any given system;
6) utilize root locus diagram to indicate the location of the poles of a closed-loop system;
7) analyse the frequency response of different control systems;
8) differentiate types of controllers; and
9) Use state space analysis as a modern method to analyse a control system.

Course Contents

Basic concepts of control system. System response characteristics. Open and closed loop systems. Review of Laplace transform and linear time-invariant systems. Transfer function. Initial value and final value theorems. Time constant form of a control system. DC gain of a system. Concept of dominant pole. Sensitivity of control system. Block diagram reduction. Signal flow graphs. Mason's gain rule. Modelling of physical systems. Translational mechanical systems. Analogous systems. Routh-Hurwitz criteria for stability of a system. Representation of transfer functions by poles and zeros on the s-plane. Computation of modulus and phase from pole-zero patterns. Residues, modulus and phase contours. Transient response from the s-plane, poles and modes. Stability assessment criterion. Damping ratios and angles. Harmonic responds locus and its derivations from the s-plane pattern by conformal transformation, gain and phase margins. Contours of closed-loop modulus and use of hall chart. Bode diagram relationship between gain and phase. Nichols diagrams and its use. Use of digital computers in solving first order differential equations. Use of digital computers in solving second order differential equations. Fundamentals of scaling. Computer-aided design and analysis of control systems.

UAES- MEE 512 Turbomachinery (3 Units; C; LH =30; PH = 0)

Learning Outcomes

At the end of this course, the students should be able to:

1. state basic laws of fluid flow and thermodynamics in association to turbomachinery;
2. Analyze turbomachinery problems associated with industry;
3. identify basic components gas turbine systems;
4. explain the design procedure of components of turbomachinery; and
5. Apply Cordier diagram for turbomachines selection.

Course Contents

Moment of momentum principles for turbines, compressors. Pumps. Fans. Performance characteristics of turbines. Specific speed. Matching of pump and load. Cascade theory and Mach number effects. Theory of steam expansion in cascade. Gas Turbine. Principles of operation and classification. Brayton cycle. Heat exchange cycle. Reheat cycle. Intercooled cycle. Intercooler. Reheat and Heat Exchange cycle. Cycle efficiencies. Combined steam and gas turbine cycles. Turbomachinery theory. Expansion of fluids in nozzles. Expansion process in turbine stator blades. work done in turbine rotors. Velocity and turbine. Pressure. Velocity and pressure-velocity compounding. Steam turbine construction. Governors. Safety devices. Glands. Couplings. Astern turbines. Blades. Rotors. Blades fixing. Seals. Casings. Condensers. Gas turbine construction. Rotors. Compressor blades. Intakes. Combustors. Turbines. Exhausts system.

UAES- MEE 514 Engineering Metallurgy (2 Units; C; LH =30; PH = 0)

Learning Outcomes

At the end of this course, the students should be able to:

1) define metallurgy;
2) identify at least seven fields of metallurgy application;
3) describe the three classes of metallurgy;
4) illustrate with the aid of a diagram the electric structure of atoms and matters;
5) list and explain the four classes of engineering materials;
6) explain the properties of materials that are related to their structures;

7) describe at least four heat treatment methods for metals;
8) list and describe the classes of polymer materials; and
9) List different types of corrosion and their prevention.

Course Contents

Introduction to the electric structure of atom and matter. Solid state crystallography. Relationship between structure and composition and the mechanical and thermal properties of materials of metals and alloys, plastics and ceramics and natural products. Heat treatment: Annealing. Normalizing. Tempering and hardening. Metallic corrosion and protection. Manufacture and properties of high polymers. Thermoplastic and thermosetting resins. Steel production. Nanomaterial. Powder metallurgy. Surface engineering. Microstructural modification and composition modification. Mechanical properties and constitutive relationships. Corrosion and stress cracking. Temperature and phase transformation. Oxidation studies for metals and alloys. Non-destructive evaluation of metals. Solidification processing.

UAES- MEE 516 Machine Design (3 Units; C; LH = 45; PH = 0)

Learning Outcomes

On completion of the course, students should be able to:
1. state applications of machine design in manufacturing process;
2. apply the design procedures;
3 state the factors for design decisions;
3. describe preliminary analysis;
4. calculate the fundamental deviation for shafts;
5. state the process for design of gear systems;
6. identify the manufacturing considerations in machine design;
7. state the effect of wrong manufacturing considerations;
7. determine stress concentration for design purposes;
8. estimate failure point in design;
9. apply dynamic loading in to machine design;
10. State the relevance dynamic loading to machine design.

Course Contents

Introduction to Machine Design. Machine Design process. Classification of design. Design process. Design decisions. Creativity and Synthesis in Design. Preliminary stress Analysis. Deflection Analysis. Factors considered for design. Design for static loading. Design for dynamic loading. Design for combined loading. Theories of failure. Stress concentration and creep. Design of keys. Design of shafts. Design of couplings.. Design of belt and pulleys. Machine fabrication. Design of Levers. Use of CAD/CAM softwares. Machines and equipment. Designing for fatigue. Machine manufacturing process planning. Machine Manufacturing resources utilization and management. Basic machine tools used in machine fabrication. Measurement instruments used design and fabrication of machines. Design and application of linkage mechanisms and cams.

37.0 - 40.0 Appendix Undergraduate degree programmes offered in the Department