ENUGU STATE UNIVERSITY OF SCIENCE AND TECHNOLOGY

Faculty of Engineering

DEPARTMENT OF METALLURGICAL AND MATERIALS ENGINEERING

STUDENT'S HANDBOOK

PROF.
ALOYSIUS MICHAEL OKOLIE
Vice Chancellor

PROF
CHIKE NWOHA
Deputy Vice Chancellor

MR
AMBROSE AMONYE UGWU
Registrar

Prof.
Chike Anibueze
Director of Academic Planning

DR
EZEMA IFEANYI JONAS
Librarian

PROF
GODIAN ONYEBUCHI MBAH
Dean of Faculty

DR. ALFRED O AGBO
Head of Department

TABLE OF CONTENTS

1. STAFF OF THE DEPARTMENT

1.	NAME OF STAFF	STATUS/ RANK
2.	Prof. Christopher Nwankwo Mbah	Professor
3.	Prof. (Mrs) Ebere Monica. Ameh	Professor
4.	Dr. Alfred Agbo	Senior Lecturer
5.	Rev.Fr. (Dr.) Celestine Chidi Nwogbu	Lecturer I
6.	Engr. Chikezie Walter Onyia	Lecturer I
7.	Engr. Ugwuanyi Bonaventure	Assistant Lecturer
8.	Engr Dr. Sylvster Afamefuna Anioke	Princip. Technologist
9.	Akwudi Louis Izu	Senr. Technologist
10.	Eng. Ogechukwu Juliana Ugwu	Tecnologist I
11.	Engr Joseph Ejike Ogbu	Tecnologist II
12.	Engr Chukwunonso Jeremiah Eneh	Technologist II
13.	Engr Ifunanya Collins Odenigbo	Technologist II
14.	Engr. Leochristeo Obinna Iyida	Technologist II
15.	Onuoha Michael Kelechi	Technologist II
16.	Engr Gabriel Nnamani	Higher Tech Off.
17.	Mr. Ani Livinus	Chief Exe. Officer
18.	Chukwu Justina Nwakaego	Ass.Chief Exe. Off
19.	Eze Charity Ada	Higher Exe Officer
20.	Mr. Edwin Ikechukwu Agunta	P.E.O. II

2. HISTORY OF THE DEPARTMENT

The Department of Metallurgical and Materials Engineering was established in September 1981 under the name: Department of Materials Science and Engineering. The change to the present name was made in 1982 because the emphasis of Metallurgical Engineering (which is part and parcel of Materials Science and Engineering), served to answer the numerous questions from the public and from prospective students who were familiar with the original name of the Department. Both names are commonly adopted by similar departments in the United States of America, Europe, and elsewhere in the world.

The first batch of students graduated from the department with the B. Eng. degree in 1985. Since then the department has continued to produce fresh batches of B. Eng. graduates each year under various heads of department (table 1)

Because the department was blessed with a large number of suitably qualified lecturers, a Postgraduate Programme was started in 1983 with a single student (a doctoral student) who withdrew from the Programme a year later for reasons of personal convenience. In September 1986, more students registered for the master's degree (M.Sc. and M.Eng) and Postgraduates Diploma (P.G.D.) Programme of the Department. Early in 1988, Mr. Jerry Ejiofor successfully defended his M.Sc. thesis and became the first graduate of the Department's Postgraduate Division. A year later (early in 1989), Mr. Romanus Madu also successfully defended his M.Sc. Thesis, and the department graduated its first batch of five P.G.D. candidates. At present, a considerable number of graduate students are registered for the P.G.D. M.Sc/M.Eng. and Ph.D. programmes. Mr Linus Okon Asuquo completed his Ph.D research work on "Studies of the selective Flocculation of Agbaja Iron ore", and defended his thesis in May 1990 to become the first Ph.D graduate of the department and of the Faculty of Engineering. Since then the department has grown tremendously especially in the quality of her academic programme.

Quality Metallurgical and Materials Engineers have been produced by this Department and a good number of them are absorbed by the local and international labour markets – Iron and steel industries, the oil and

gas sector, the manufacturing industries, education, government, etc (see attached: graduate employment records).

The degree prorgamme of the Department has been periodically examined and accredited by the National University Commission (NUC) and the Council for the Regulation of Engineering Practice in Nigeria (COREN). The last COREN accreditation exercise was in 2018 when the Department was given full accreditation. The department had always had full accreditation from both NUC and COREN and is determined to achieve full accreditation again.

In the final/degree examinations for the graduation of students the services of external examiners from other accredited universities are always employed as shown in table 2

Table 2. List of External Examiners

SN	ACAD. SESSION	NAME	UNIVERSITY
1.	1991-1993	Prof. S. A. Balogun	University of Lagos
2.	1993-1996	Dr. M. Katchy	Nnamdi Azikiwe
3.	1996-1999	Prof. F. F. Orumwense	University of Benin.
4.	1999-2003	Prof. O.O. Onyemboli	Federal University of Tech.
5.	2003-2008	Prof. E. E. Nnuka	University of Agriculture
6.	2008-2012	Prof. L. N. Ijomah	Nnamdi Azikiwe
7.	2012-2017	Prof. O. O. Onyemboli	Federal University of Tech.
8.	2017-2018	Prof. S. I. Neife	Federal University
9.	2018-2022	Prof. V. S. Aigbodion	University of Nigeria,
10.	2022-2023	Prof. C. I. Nwoye	Nnamdi Azikiwe

Table 1: List of Heads of Department

S/N	YEAR	NAME	UNIVERSITY
1	1980 – 1987	Prof. I. C. Ukaegbu	Univ. of Nig., Nsukka
2	1987 – 1991	Prof. B. A. Okiotor	University of Benin.
3	1991 – 1993	Dr. E. Nebo	Fed. Univ. of Tech.
4	1993 – 1997	Prof. C. O. Nwaji	Univ. of Nig., Nsukka
5	1997 – 2003	Dr. S. I. Neife	University of Agriculture
6	2003	Engr. F. O. Mkpugwu	Nnamdi Azikiwe
7	2003 – 2005	Engr. J. C. Ugwuoke	Nnamdi Azikiwe
8	2005 – 2007	Prof. C. N. Mbah	Univ. of Nig., Awka.
9	2007 – 2011	Engr. J. C. Ugwuoke	Federal University of Tech.
10	2011 – 2012	Prof. Mrs. O. M. Ameh	Univ. of Nig., Nsukka
11	2012 – 2013	Engr. A. C. Mbah	Federal University
12	2013 – 2017	Prof. C. N. Mbah	Univ. of Nig., Awka
13	2017 – 2019	Prof. Mrs. O. M. Ameh	Univ. of Nig., Nsukka
14	2019 – 2022	Dr. Agbo, S. O.	Nnamdi Azikiwe
15	2022 – 2023	Prof. C. N. Mbah	Univ. of Nig., Awka
16	2023	Dr. Agbo, S. O.	Nnamdi Azikiwe

3. MOTTO, VISION AND MISSION OF THE UNIVERSITY

Motto

The motto of the University is: Technology for Service

Vision

The vision of the University is: To be an outstanding internationally respected University in Africa with strong commitment to rigorous scholarship that promotes service to humanity through quality teaching, research and community social responsibility.

4. Mission

The mission of the University is: To produce graduates that can favourably compete with their counterparts all over the world and to promote scholarship, especially in the areas of Science, Management and Technology, thereby ensuring the development of quality manpower that will utilize technology for the service of the society.

5. PROGRAMME PHILOSOPHY EDUCATIONAL OBJECTIVES (PEOs):

(a). Philosophy and Mission Statement

The Philosophy and Mission Statement underlying the programmes of the Department is aimed at achieving the goals and objectives of the National Policy on Industrialisation and Self-Reliance. This is to be achieved through:

(i) Broad–based foundation in Engineering as well as specialized knowledge and practice in Materials and Metallurgical Engineering.

(ii) Practical exposure to application of Materials and Metallurgical Engineering in particular and Engineering in general to problem solution.

(iii) Adequate training of Materials and Metallurgical Engineering Students on human and organizational behaviour and management.

(iv) Developing products entrepreneurial knowledge in the Students of Metallurgical and Materials Engineering and inculcating in them a sense of public responsibility and a spirit of self-reliance.

(v) Nurturing of partnership between the Department/University and industry for effective programme delivery.

(vi) Creating among staff and students deep awareness and understanding of the moral, ethical, legal, and professional obligations needed to function as part of a professional enterprise while protecting human health and welfare and the environment in a global society.

(vii) Creating an awareness and understanding of the need to develop leadership and team building skills to maximize the benefits of an engineering education and its application to solving problems

(viii) Providing a forum for learning, research, manpower training, and technology development in the field of Materials Science and Engineering. The department believes that by seeking and disseminating knowledge in this field, she will be enhancing the ability of our people to develop and exploit our nation's rich material resources, including the vast reserves of metallic materials, ceramics and glasses, polymers, semiconductor (micro-electronic) materials, and wood.

The general philosophy of the programme therefore is to produce graduates of Materials and Metallurgical Engineering with high academic and ethical standards and adequate practical exposure for self-employment as well as being of immediate value to industry and the community in general.

(b). Programme Educational Objectives

The **Programme Educational Objectives** of the B. Eng. MME programme are to:

1. Demonstrate a strong foundation in scientific principles, technical knowledge, and practical skills necessary for the field and be equipped to apply their understanding of metallurgy and materials science to solve complex

engineering problems and contribute to technological advancements.
2. Possess effective communication and teamwork skills, enabling them to collaborate with multidisciplinary teams and effectively convey technical information to diverse audiences and hence demonstrate professionalism, ethical conduct, and a commitment to social responsibility in their engineering practice.
3. Develop professionally throughout their careers, engaging in lifelong learning and adapting to emerging technologies and industry trends.
4. Demonstrate leadership qualities and contribute to the advancement of metallurgical and materials engineering through research, innovation, and entrepreneurship, thereby serving the needs of society and making meaningful contributions to sustainable development.

(c). POs of ESUT-MME and their publication

A graduate of ESUT Metallurgical and Material Engineering is expected to possess the ability to:

1.Engineering Knowledge: solve developmental and complex engineering problems through applied knowledge of mathematics, science, engineering fundamentals and Metallurgical and Material Engineering principles.

2. Problem Analysis: identify/formulate, research literature and analyse developmental and complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences;

3.Design/Development of Solutions: advance solutions for developmental or complex engineering problems and design systems, components or processes that meet specified needs with appropriate consciousness for public health and safety, cultural, societal and environmental peculiarities;

4.Investigation: investigate into developmental or complex problems using research based knowledge and research methods including design

of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions;

5.Modern Tool Usage: create, select and apply appropriate techniques, resources and modern engineering and ICT tools, including prediction, modelling and optimization to developmental and complex engineering activities, with an understanding of the limitations;

6.The Engineer and Society: apply informed reasoning through contextual knowledge which includes Humanities and Social Sciences to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice;

7.Environment and Sustainability: understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development;

8.Ethics: imbibe ethical principles and commit to professional responsibilities and norms of engineering practice, including adherence to the COREN Engineers Code of Conducts;

9.Individual and Team Work: function effectively as an individual, a member or as a leader in diverse teams and in multi-disciplinary settings;

10.Communication: communicate effectively on developmental or complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions;

11.Project Management: demonstrate knowledge and understanding of engineering, management and financial principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments;

Lifelong Learning: recognize the need for, and have the preparations and ability to engage in independent and lifelong learning in the broadest context of technological and social changes.

6. ADMINISTRATION IN GENERAL OF PROGRAMME

(a). **Organizational Structure:**

The department's organizational structure is shown in figure 1.

The department is headed by a head of department, appointed from the ranks of the senior academic staff of the department. The head of department has such administrative support staff as a typist (or secretary), a clerical officer (Or administrative/executive officer) and an office attendant. The chart highlights the freedom of interaction existing between the students and the academic staff, technologist (laboratory staff) and the office of the Head of Department.

(b). **How staff are involved in the Decision-making process and in General Administration:**

At the departmental level, the departmental Board is the highest policy makers in the Department. This Departmental Board is made up of all the Lecturers, Senior Administrative Staff and Senior Professional Staff in the Department. The Board decides on any change in the programme.

(c). **Policy and Practice on staff Development:**

The department has very liberal policy on staff development. Both academic and technological staffs are encouraged to

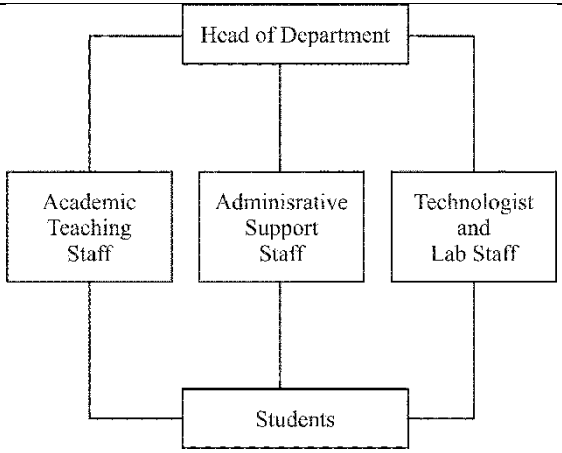

Fig. 1. Organizational Structure of the Department

undertake higher training programmes of the University. Staff on full study leave is paid a prescribed allowance, and are required to return to the department immediately their programmes are over. Currently, three of our lecturers are undergoing Ph.D programmes.

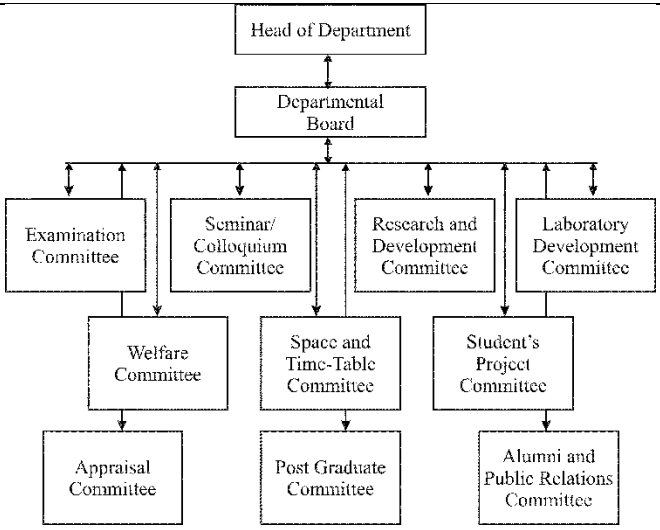

Fig. 2 Committees of the Department

7. OUTLINE OF COURSES

YEAR ONE FIRST SEMESTER

Course Code	Course Title	CU	St	LH	PH
GST 111	Communication in English I	2	C	30	-
GST 113	Nigerian Peoples and Culture	*2*	R	30	-
GST 121	Use of Library, Study Skills & ICT	2	C	30	
ICH 111	General Chemistry 1	3	C	45	
ICH197	General Practical Chemistry I	1	C	-	45
MAT 111	Elementary Mathematics I	3	C	45	-
PHY 111	General Physics I	3	C	45	-
PHY 197	General Practical Physics I	1	C	-	45
CEE 121	Computer Programming	2	R	30	-
	TOTAL UNITS	**19**			

YEAR ONE SECOND SEMESTER

Course Code	Course Title	CU	St	LH	PH
GST 112	Communication in English II	2	C	30	-
MEC 122	Basic Engineering Drawing	2	C	15	45
ICH 112	General Chemistry II	3	R	45	-
ICH 198	General Practical Chemistry II	1	R	-	45
MAT 112	Elementary Mathematics II	3	R	45	-
PHY 112	General Physics II	3	R	45	-
PHY 198	General Practical Physics II	1	R	-	45
GST 114	Social Sciences	2	R	45	-
MME 122	Engineering Materials	3	C	45	-

GST 118	Peace Studies and Conflict Resolution	2	R	45	-
	TOTAL UNITS	**22**			

YEAR TWO FIRST SEMESTER

Course Code	Course Title	CU	St	LH	PH
EEE 221	Applied Electricity I	3	C	45	-
MEC 223	Engineering Drawing I	2	C	15	45
CHE 225	Fundamentals of Fluid Mechanics	3	C	45	-
CVE 227	Applied Mechanics	3	C	45	-
FEG 227	Engineering Mathematics 1	3	R	45	-
FEG 221	Engineer in Society	2	R	30	-
FEG 293	General Engineering Laboratory Course	1	R	-	45
	TOTAL UNITS	17			

YEAR TWO SECOND SEMESTER

Course Code	Course Title	CU	St	LH	PH
ENS 222	Introduction to Entrepreneurship	2	R	30	-
EEE 222	Applied Electricity II	3	C	45	-
MEC 224	Engineering Drawing II	2	C	15	45
FEG 294	Students Workshop Experience	1	C	-	45
CHE 226	Fundamentals of Thermodynamics	3	C	45	-
CVE 228	Strength of Materials	3	C	45	-
FEG 228	Engineering Mathematics II	3	R	45	-
FEG 290	SIWES I	2	C	8weeks	
	TOTAL UNITS	**19**			

YEAR THREE FIRST SEMESTER

Course Code	Course Title	CU	St	LH	PH
FEG 321	Engineering Mathematics III	3	R	45	-
ENS 311	Entrepreneurship Practicum	2	C	30	-
MME 341	Manufacturing Technology	2	R	30	-
MME 343	Welding and joining processes	2	R	30	
MME 321	Transport Phenomenon in Metallurgy	2	C	30	-
MME 363	Thermodynamics of Materials	2	C	30	-
MME 361	Physical Chemistry of Materials	2	C	30	-
MME 309	Fuels Furnaces and Refractories	2	R	30	-
MME 305	Engineering Communication	2	R	30	-
MME 395	Laboratory Practical I	1	C	-	45
	TOTAL UNITS	**20**			

YEAR THREE SECOND SEMESTER

Course Code	Course Title	CU	St	LH	PH
FEG 322	Engineering Mathematics IV	3	R	45	-
MME 342	Foundry Theory and practice	2	C	30	-
MME 324	Engineering Materials: Structure and Properties	2	C	30	-
MME 362	Mineral Processing	2	C	30	-
MME 352	Mechanical Metallurgy I	2	R	30	-
MME 332	Physical Metallurgy I	2	C	30	-
MEC 326	Engineering Drawing III	3	C	15	90

MME 312	Technology Policy and Development.	2	C	30	-
MME 396	Laboratory Practicals II	1	C	-	45
GET 390	SIWES II	3	C	12 weeks	
	TOTAL UNITS	**22**			

YEAR FOUR FIRST SEMESTER

Course Code	Course Title	CU	St	LH	PH
MME 441	Synthesis, Processing, and Manufacturing of Materials	2	C	30	-
MME 463	Extractive Metallurgy I	2	C	30	-
MME 495	Laboratory Practicals III	3	C	15	90
MME 451	Materials Engineering Design	2	C	30	-
MME 471	Corrosion Science and Engineering	2	C	30	-
MME 403	X-ray Diffraction & Analytical Techniques	2	C	30	-
MME 411	Ceramic and Glass Engineering	2	E	30	-
MME 433	Principles of Phase Diagram	2	C	30	-
	TOTAL UNITS	**17**			

YEAR FOUR SECOND SEMESTER

Course Code	Course Title	CU	St	LH	PH
MME 490	SIWES III	6	C	24 weeks	
	TOTAL UNITS	**6**			

YEAR FIVE FIRST SEMESTER

Course Code	Course Title	CU	St	LH	PH
MME 501	Engineering Management	3	R	45	-
MME 551	Metallurgical Engineering Equipment and Plant Design	2	C	30	-
MME 565	Chemical Metallurgy	2	R	30	-
MME 553	Powder Metallurgy	2	R	30	-
MME 513	Polymeric Materials Engineering	2	R	30	-
MME 531	Physical Metallurgy II	2	C	30	-
MME 511	Engineering Materials selection and Application	2	R	30	-
MME 595	Laboratory Practicals IV	2	C	-	90
	TOTAL UNITS	**17**			

YEAR FIVE SECOND SEMESTER

Course Code	Course Title	CU	St	LH	PH
MME562	Iron & Steel Making/Heat Treatment Practice	3	C	45	-
MME 502	Engineering Law	2	R	30	-
MME 564	Extractive Metallurgy II	2	C	30	-
MME 532	Solid State Materials & Technology	2	R	30	-
MME 554	Mechanical Metallurgy II	2	C	30	-
MME 599a	Seminar	3	C	45	-
MME 599	Project	3	C	-	135
TOTAL UNITS		**17**			

8. COUSE CONTENT LISTING

GST 111 Communication in English I. 2 Units	
Course Learning Outcomes (CLOs) **At the end of the course the students should be able to:**	**POs**
identify possible sound patterns in English Language;	1,2, 3,4
list notable language skills;	1,2,4
classify word formation processes;	1, 2,3
construct simple and fairly complex sentences in English;	4
apply logical and critical reasoning skills for meaningful presentations;	1,4
demonstrate an appreciable level of the art of public speaking and listening;	4
write simple and technical reports.	4
Course Content Effective communication and writing in English, language skills, writing of essay answers, comprehension, sentence construction, outlines and paragraphs, collection and organization of materials and logical presentation, punctuation, word and word usage, rules of concord, idioms and figurative expressions, introduction to literature I.	

GST 112: Nigeria People and Culture – 2 Units	
Course Learning Outcomes (CLOs) **At the end of the course the students should be able to:**	**POs**
analyse the historical foundation of Nigerian cultures and arts in pre-colonial times;	6,10
identify and list the major linguistic groups in Nigeria;	6,10
explain the gradual evolution of Nigeria as a political entity;	6,10
analyse the concepts of trade and economic self-reliance of Nigerian peoples in relation to national development;	6,7
enumerate the challenges of the Nigerian state regarding nation building;	6,10,11

identify the acceptable norms and values of the major ethnic groups in Nigeria;	6,8
list possible solutions to identifiable Nigerian environmental, moral and value problems.	6,7,10,11,12

Course Content

Study of Nigerian history, culture arts in pre-colonial times, Nigerian's perception of his world, culture areas of Nigeria and their characteristics, evolution of Nigeria as a political unit, indigene/settler development, Norms and values, negative attitudes and conducts (cultism and related vices), re-orientation of moral and national values, moral obligations of citizen, environmental problems. The spirit of nationalism: Patriotism, personal and group discipline. Self-reliance, endurance and maintenance culture; aimed at restoreing and encouraging research for indigenous traditional and Nigerian cultural heritage.

GST 121: Use of Library, Study Skills & ICT– 2 Units	
Course Learning Outcomes (CLOs) **At the end of the course the students should be able to:**	**POs**
1. Acquaint themselves with the parts of a book and the different types of libraries resources including the use of media resources	6,10
2. Understand the purpose of the University Library, the kind of materials it acquires and their physical arrangement and organization.	6,10
3. Have a general idea of classification systems used in libraries as God was the first classifier.	6,10
4. Know or have knowledge of how to select books on their subject areas as well as spiritual growth	6,10
5. Know how to use the card catalogue and ability to search for information beyond the catalogue e.g. internet search.	6,10
6. Familiarize them with the major reference books both general and specialized, what they are and how to use them	6,10

Course Content

Brief history of libraries; Library and education; University libraries and other types of libraries; Study skills (reference services); Types of library materials, using library resources including e-learning, e-materials, etc.; Understanding library catalogues (card, OPAC, etc.) and classification; Copyright and its implications; Database resources; Bibliographic citations and referencing. Development of modern ICT; Hardware technology; Software technology; Input devices; Storage devices; Output devices; Communication and internet services; Word processing skills (typing, etc.)

ICH 111: General Chemistry I – 3 Units	
Course Learning Outcomes (CLOs) **At the end of the course the students should be able to:**	**POs**
define atom, molecules and chemical reactions;	1,2,4,5
discuss the modern electronic theory of atoms;	1
write electronic configurations of elements on the periodic table;	1
rationalise the trends of atomic radii, ionisation energies, electronegativity of the elements, based on their position in the periodic table;	1
identify and balance oxidation–reduction equation and solve redox titration problems;	1,2
draw shapes of simple molecules and hybridised orbitals;	1,2
identify the characteristics of acids, bases and salts, and solve problems based on their quantitative relationship;	1,2,4
apply the principles of equilibrium to aqueous systems using Le Chatelier's principle to predict the effect of concentration, pressure and temperature changes on equilibrium mixtures;	1,2,4,5
analyse and perform calculations with the thermodynamic functions, enthalpy, entropy and free energy;	1,2
determine rates of reactions and its dependence on concentration, time and temperature.	1,2,4
Course Content Atoms, Dalton's atomic theory and atomic masses. Fundamental particles of the atom and atomic structure. Modern electronic theory of atoms. Periodicity of elements, mole concept, chemical formulae equations. States of matter; gas, liquid and solid. Energetic and thermo chemistry, chemical kinetics; equilibria and electrochemistry.	

ICH 197: General Practical Chemistry I (1 Unit)	
Course Learning Outcomes (CLO): Upon completion of this course, students will be able to:	**POs**
1. state the general laboratory rules and safety procedures;	**1,1,8**
2. collect scientific data and correct carry out chemical experiments;	1,2,4
3. identify the basic glassware and equipment in the laboratory;	1,5
4. state the differences between primary and secondary standards;	1
5. perform redox titration;	1,2,4
6. record observations and measurements in the laboratory notebooks; and	1,5
7. Analyse the data to arrive at scientific conclusions.	1,2
Course Content	

Theory and practice of qualitative chemical analysis, calculation, data analysis and presentation. Acid-base, oxidation-reduction reactions, Precipitation and complex volumetric titrations. Gravimetric analysis.	

MAT 111: General Mathematics I – 3 Units	
Course Learning Outcomes (CLOs) **At the end of the course the students should be able to:**	**POs**
define and explain set, subset, union, intersection, complements, and demonstrate the use of Venn diagrams	**1,2**
solve quadratic equations and trigonometric functions;	1,2
identify various types of numbers and solve some problems using binomial theorem.	1,2
Course Content Elementary set theory, subsets, union, intersection, complements and Venn diagrams. Real numbers, integers, rational and irrational numbers. Mathematical induction, real sequences and series and arithmetic and geometric progressions. Theory of quadratic equations. Binomial theory, complex numbers, algebra of complex numbers, the Argond diagram, De Moivre's theorems and the nth roots of unity. Circular measure; trigonometric function of angles of any magnitude, addition and factor formulae.	

PHY 111: General Physics I – 3 Units	
Course Learning Outcomes (CLOs) **At the end of the course the students should be able to:**	**POs**
identify and deduce the physical quantities and their units;	
differentiate between vectors and scalars;	
describe and evaluate motion of systems on the basis of the fundamental laws of mechanics;	
apply Newton's laws to describe and solve simple problems of motion	
evaluate work, energy, velocity, momentum, acceleration, and torque of moving or rotating objects	
explain and apply the principles of conservation of energy, linear and angular momentum	
describe the laws governing motion under gravity; and	
explain motion under gravity and quantitatively determine behaviour of objects moving under gravity.	

Course Content
Units and dimensions: scalar and vectors. Particle kinetics. Newton's laws. Friction, work and energy, center of mass. Simple harmonic motion and rigid body dynamics. Kepler's law. Pressure in fluids, intermolecular forces, Hooke's law and Young's modulus, fluid flow, streamline turbulence, Stoke's law and surface tension.

CEE 121: Computer Programming - 3 Units	
Course Learning Outcomes (CLOs) **At the end of the course the students should be able to:**	**POs**
1. describe and apply computing, software engineering knowledge, best practices, and standards appropriate for complex engineering software systems;	1,2
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++;	1,2
3. use widely available libraries to prepare them for machine learning, graphics and design simulations;	1,2
4. develop skills in eliciting user needs and designing an effective software solution;	1,2
5. recognize human, security, social, and entrepreneurial issues and responsibilities relevant to engineering software and the digitalization of services; and	1,2
6. acquire capabilities that can further be developed to make them productively employable by means of short internet courses in specific areas.	1,2
Course content 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.	

PHY 197: GENERAL PRACTICAL PHYSICS I (1unit)	
Course Learning Outcomes (CLO): **Upon completion of this course, students will be able to:**	**POs**
1. conduct measurements of some physical quantities	4,5
2. make observations of events, collect and tabulate data	4,5
3. identify and evaluate some common experimental errors	4
4. plot and analyse graphs	1,2
5. draw conclusions from numerical and graphical analysis of data	5,1,2
6. prepare and present practical reports.	10
Course Content Laboratory experiments designed to reflect the topics taught in ICH 112 and ICH 111 such as qualitative and quantitative chemical analysis, acid-base titrations. Gravimetric analysis. Calculation, data analysis and presentation. Functional group analysis.	

GST112: Communication in English II (2 Units:)	
Course Learning Outcomes (CLO): **Upon completion of this course, students will be able to:**	**POs**
Course Content Logical presentation of papers; phonetics; Instruction on lexis; Art of publics peaking and oral communication; figures of speech; précis; Report writing.	

GST 118: PEACE AND CONFLICT RESOLUTION (2 Units)	
Course Learning Outcomes (CLOs) **At the end of the course the students should be able to:**	**POs**
1. define and explain the meaning and nature of conflict	6
2. discuss the causes and types of conflicts	6
3. discuss issues on conflict analysis, management, resolution and transformation	6
4. explain the processes of conflict resolution – mediation negotiation, arbitration, litigation, conciliation and so on	6
5. give detailed explanation of peace education mechanical and production engineering,	6
6. examine the role of communication and language in conflicts	10
7. explain the importance of the rules of conflict intervention	8
8. determine the latent stage of conflict and possible responses	6
9. discuss and be familiar with global issues and peace-building.	6
Course Content Basic concepts in peace studies and conflict resolution; peace as vehicle of	

unity and development; conflict issues; Types of conflict, e.g. Ethnic/religious/political/economic conflicts, Root causes of conflict and violence in Africa; Indigene/settler phenomenon; peace- building, management of conflict and security. Elements of peace studies and conflict resolution, developing a culture of peace; Mechanical and Production Engineering, ESUT 79 peace mediation and peace-keeping; Alternative dispute resolution (ADR). Dialogue/arbitration in conflict resolution; Role of international organizations in conflict resolution e.g. ECOWAS, Africa Union, United Nations, etc.

GST 114: Social Sciences (2 Units)	
Course Learning Outcomes (CLOs) **At the end of the course the students should be able to:**	**POs**
1. understand the concepts of geography as a scientific discipline	6
2. examine the sense of location specification, including an appreciation of forms and structure of nigerian settlement pattern, economic activities and challenges	6
3. provide understanding on the relationships in economic and political geography of both in history and in the contemporary with the aim of creating environmental consciousness	7
Course content Man – his origin and nature, man and his cosmic environment, scientific methodology, science and technology in the society service of man, renewable and non-renewable resources – man and his energy resources, environmental effects of chemical plastics, textiles, wastes and other materials, chemical and radiochemical hazards, introduction to the various areas of science and technology. Element of environmental studies.	

MEC 112: Basic Engineering Drawing (2 Units)	
Course Learning Outcomes (CLO): **Upon completion of this course, students will be able to:**	**POs**
elucidate drawing as a means of communication.	10
2. construct borderlines and dimensioning.	3
3. illustrate drawing, measuring, lettering and dimensioning of objects in various views/positions;	3
4. identify the various types of lines, their applications and geometry;	3

5. demonstrate the geometrical construction of parallel and perpendicular lines, bisection and division of lines,	3
6. draw construction and bisection of angles.	3
7. construct triangles, inscribed, ascribed and circumscribed circles of triangle, quadrilaterals, polygons, circle and geometrical construction on circle	3
8. demonstrate freehand sketching, symbols, conventions an scales	3
Course Content Introduction to Engineering Drawing as a means of communication. Drawing paper format. Use of drawing instruments. Types of lines sand their uses in Engineering Drawing. Circles and tangent. Circles to satisfy conditions involving other circles, lines and points. Conic sections, various methodsof their construction. Cycloid, epi and hypocyclodis. Involute. Archimedes spiral. Loci: the helix (cylindrical and conical) single and multi-start threads. Coiling of compression and tension springs. Loci-Paths of points on moving link work. The theory of projection. Perspective (briefly), parallel projections (oblique general, cavalier, cabinet). (Orhographic-Multi-view, two view, three views, auxiliary views). (Axonometric-Isometric, diametric, trimetric). Multiview representation. 1st and 3rd angle representations. Isometric drawing. Oblique drawings. Revisions	

ICH 112: General Chemistry II (3 Units)	
Course Learning Outcomes (CLO):Upon completion of this course, students will be able to:	**POs**
1. state the importance and development of organic chemistry;	1
2. define fullerenes and its applications;	1
3. discuss electronic theory;	1
4. determine the qualitative and quantitative of structures in organic chemistry;	1
5. state rules guiding nomenclature and functional group classes of organic chemistry;	1
6. determine the rate of reaction to predict mechanisms of reaction;	1
7. identify classes of organic functional group with brief description of their chemistry;	1
8. discuss comparative chemistry of group 1a, iia and iva elements; and	1
9. describe basic properties of transition metals.	1
History survey of the development and importance of Organic chemistry, electronic theory in organic chemistry. Isolation and purification of organic	

compound Determination of structures of organic compounds including qualitative and quantitative analysis inorganic chemistry. Nomenclature and functional group classes of organic compounds. Introductory reaction mechanism and kinetics. Sterero chemistry. The chemistry of alkanes, alkenes, alkynes, alcohols, ethers, amines, alkyhalides, nitriles, aldehydes, ketones, carboxylic acids and derivative. The chemistry of selected metals and non-metals. Comparative chemistry of groups 1A, IIA and IVA elements. Introduction to transition metal chemistry

ICH 198: General Practical Chemistry II (1 Unit)	
Course Learning Outcomes (CLO): Upon completion of this course, students will be able to:	**POs**
1. state the general laboratory rules and safety procedures;	7
2. collect scientific data and correctly carry out chemical experiments;	5
3. identify the basic glassware and equipment in the laboratory;	5
4. identify and carry out preliminary tests which include ignition, boiling point, melting point, test on known and unknown organic compounds;	1
5. carry out solubility tests on known and unknown organic compounds;	1
6. carry out elemental tests on known and unknown compounds; and	1
7. carry out functional group/confirmatory test on known and unknown compounds which could be acidic/basic/ neutral organic compounds.	1
Course Content Continuation of laboratory experiments designed to reflect the topic taught in ICH 111 and ICH 112. Some of the experiments will have been carried out in ICH 117.	

MAT 112: Elementary Mathematics II (Calculus) (3 Units)	
Course Learning Outcomes (CLO): Upon completion of this course, students will be able to:	**POs**
1. identify the types of rules in differentiation and integration;	1,2
2 .recognise and understand the meaning of function of a real variable, graphs, limits and continuity;	1,2
3. solve some applications of definite integrals in areas and volumes;	1,2

4. solve function of a real variable, plot relevant graphs, and identify limits and idea of continuity;	1,2
5. identify the derivative as limit of rate of change;	1,2
6. identify techniques of differentiation and perform extreme curve sketching;	1,2
7. identify integration as an inverse of differentiation;	1,2
8. identify methods of integration and definite integrals; and	1,2
9. perform integration application to areas, volumes.	1,2
Course Content 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 simpon's rule).	

PHY 112 General Physics II (3 Units)	
Course Learning Outcomes (CLO): Upon completion of this course, students will be able to:	**POs**
1. explain the general properties of waves.	1,2
2. describe the general properties of sound.	1,2
3. describe what static electricity is and how it originates.	1,2
4. demonstrate an understanding of electrical potential.	1,2
5. analyse electrical circuits. .	1,2
6. define the properties of magnetic fields.	1,2
7. clarify how light interacts with lenses and mirrors. .	1,2
8. label optical phenomena associated with the wave properties of light.	1,2
9. designate quantum theory and how it relates to the model of the atom	1,2
Course Content Electrostatics; conductors and currents; dielectrics, magnetic fields and electro-magnetic induction; maxwell's equations; electromagnetic oscillations and waves; coulomb's law; methods of charging; ohm's law and analysis of DC circuits; AC voltages applied to inductors, capacitors and resistance. Applications.	

PHY 198 General Practical Physics II (1 Unit)	
Course Learning Outcomes (CLO): Upon completion of this course, students will be able to:	**POs**

1. prepare a written laboratory report that effectively interprets and communicates their results.	10
2. effectively use computers as a tool for communication, data collection, data analysis.	5,10
3. perform at least 10 laboratory activities where students collect, organize and analyse data demonstrating concepts from the 8 major objectives listed above	4,5
Course Content: This is a continuation of the experiments designed for PHY 111 and PHY 112 some of which have been covered under PHY 197	

MME 122 Engineering Materials – 2 Units	
Course Learning Outcomes (CLOs) **At the end of the course the students should be able to:**	**POs**
list the main classes of engineering materials.	1, 3, 7
enumerate the important properties of each of the main classes of engineering materials.	1, 3, 7
calculate the total energy of an electron in nth orbit.	1
describe the four quantum numbers	1
explain electronic configuration and the aufbau principles.	1
describe the different types of bonding, both primary and secondary bonding, with sketches.	1, 3
name the three most common metal crystal structures and give examples of metals which have each of these crystal structures.	1
sketch the unit cells of bcc, fcc and hcp crystal structures and calculate the packing efficiency of each of them.	1
distinguish between a metal, an alloy and a composite material.	1
explain different fabrication methods in engineering and give examples of products made from each of them.	1,3
Course content Introduction to electronic configuration, atomic structures, inter-atomic bonding mechanisms, crystal and micro-structure, relationships between structure and properties of metals, alloys, ceramics and plastics. Principles of the behaviour of materials in common environments. Fabrication processes and applications.	

EEE 221: Applied Electricity I – 3 Units	
Course Learning Outcomes (CLOs) **At the end of the course the students should be able to:**	**POs**

solve the electrical networks mathematically.	1,2
apply the elementary knowledge of electromagnetism.	1
distinguish between dc and ac circuits and analyse them.	1,2
explain the basic principles of electric machines.	1
Course Content Circuits – elements, DC and AC circuits, basic laws and theorems. Resonance, power, power factors, 3-phase circuits. Introduction to machines and machine designs. Physics of devices – discharge devices, semi-conductors, diodes and transistors.	

MEC 223: Engineering Drawing I (2 Units)	
Course Learning Outcomes: **At the end of the course, the students should be able to:**	**POs**
1. apply multi-view representation techniques accurately to represent objects in different views, demonstrating proficiency in both first and third angle projection methods.	1,10
2. create isometric drawings and simple pictorial assembly drawings, accurately representing the spatial relationship between components and assemblies.	5,10
3. generate oblique drawings using different techniques such as cavalier, cabinet, and angles other than 45 degrees, effectively communicating the shape and features of objects.	5,10
4. apply proper dimensioning techniques, including the selection and placement of dimension lines, the use of tolerances, and the application of gd&t symbols, ensuring clear and accurate communication of size and shape requirements.	5,10
5. interpret and create sections and auxiliary views, correctly representing the internal features and hidden details of objects, and apply the appropriate conventions for representing threads, bolted joints, keys, cottered joints, and other mechanical components based on relevant standards such as bs 308	5,9, 10
Course Content Revision of multi-view representation. Harder examples on two and three view representation (1st and 3rd Angles). Harder examples on isometric drawing to include simple pictorial assembly drawing in isometric. Harder examples on oblique drawing (Cavalier, Cabinet and Angles other than 45 degres). Dimensioning. Sections and conventions. Auxiliary views. Representation and specification of threads. Bolted joints. Keys and cottered joints. Conventional representations (see BS 308)	

CHE 225: Fundamentals of Fluid Mechanics.
Course Learning Outcomes (CLOs) **At the end of the course the students should be able to:**
explain the general concept of fluid and further identifying the properties of fluids,
demonstrate friction effects and losses in laminar and turbulent flows ducts and pipes
analyze the concept of dimensional analysis and dynamic similitude
explain and illustrate fluids statics conservation laws
analyze the phenomena regarding principles of construction and operation of selected hydraulic machinery.
identify and use hydro power systems.
Course Content: Properties of fluids, fluids statics conservation laws, friction effects and losses in laminar and turbulent flows ducts and pipes. Dimensional analysis and dynamic similitude, principles of construction and operation of selected hydraulic machinery. Hydro power systems.

CVE 227: Applied Mechanics – 3 Units
Course Learning Outcomes (CLOs) **At the end of the course the students should be able to:**
understand and apply different coordinate systems and position vectors to analyze the position and orientation of particles and rigid bodies.
analyze the kinematics of particles in plane motion in different coordinate systems, including calculating displacement, velocity, and acceleration.
apply newton's laws of motion to analyze the kinetics of particles in plane motion, including understanding different types of forces and their effects on individual particles and systems of particles.
determine the center of mass of a system of particles and apply it to solve problems related to the equilibrium and motion of systems.
analyze simple harmonic motion, including calculating displacement, velocity, and acceleration, and understand the concept of impulse and momentum.
analyze the kinematics of a rigid body in plane motion, including different types of motions, relative motion between two points on a rigid body, and constructing velocity diagrams.
apply newton's laws of motion to analyze the kinetics of a rigid body in plane motion, including calculating forces, moments, and understanding equilibrium conditions.
apply the principles of work and energy to analyze the motion of a system of particles, including calculating work, kinetic energy, and potential

energy.
apply general energy principles, including the conservation of energy, to analyze and solve problems related to the motion of particles and rigid bodies.
understand and apply the concept of virtual work and D'Alembert's principles to analyze the equilibrium and motion of particles and rigid bodies under the influence of constraints and forces.
Course content Co-ordinate system and position vectors; Kinematics of particles in plane motion in different co-ordinates; Displacement, Velocity and Acceleration of a particle: Kinetics of particles in plane motion. Newtons' laws: Types of forces; system of particles. Center of mass; Simple harmonic motion; impulse and momentum; Kinematics of a rigid body in plane motion: Types of motions, Relative motion between two points on a rigid body; velocity diagrams; instantaneous center of rotation; Kinetics of rigid body in plane motion; work and energy for a system of particles; kinetics of a rigid body; potential energy; General energy principles; virtual work; D'Alembert's principles.

FEG 227: Engineering Mathematics I. 3units
Course Learning Outcomes (CLOs) **At the end of the course the students should be able to:**
carry out addition and subtraction of complex numbers, multiplication of complex numbers, conjugate complex number and division of complex numbers.
carry out of addition of two vectors, multiplication of vector by scalars, orthogonal triad of unit vectors, vector products, laws of cross products.
describe trigonometric rations and trigonometric identity.
explain exponential functions and logarithmic function
guide to solving partial fractions, solve denominator with repeated and quadratic factors.
carry out arithmetic series, geometric series, geometric mean.
see integration as reverse process of differentiation, fine a function whose derivative we already know.
carry out addition and subtraction of polynomials, types of polynomials, multiplication and division of polynomials, factor theorem.
basic concepts, carry out addition and subtraction of matrices, multiplication of matrices, determinant of matrix, eigenvalues and eigenvectors, linear equations.

Course Content: Complex Numbers, Vectors, Trigonometry, Exponential and Logarithmic Function, Partial Fractions, Sequences and series, Differentiation, Integration, Element of Linear Algebra, Polynomials, Matrices

CEE 221: Introduction to Modeling and Simulation – 2 Units
Course Learning Outcomes (CLOs) **At the end of the course the students should be able to:**
demonstrate the fundamental concepts and principles of modeling and simulation
apply mastery of use of MATLAB
develop skills in MATLAB scripts, MATLAB arrays, linear models, graphing data in MATLAB, MATLAB array math, advanced graphing in MATLAB, nonlinear functions, nonlinear modeling examples, curve fitting
analyze and optimize designs using simulation tools link Simulink..
optimize and recognize/ understand the practical link to excite their creativity
perform and institute a concept in modeling and simulation for creative innovation.
Course content This is the introductory course for the modeling and simulation (M&S). The course presents an introduction to the theory and practice of modeling and simulation. Introduction to modeling, modeling concepts and definitions, introduction to MATLAB, MATLAB scripts, MATLAB arrays, linear models, graphing data in MATLAB, MATLAB array math, advanced graphing in MATLAB, nonlinear functions, nonlinear modeling examples, curve fitting, MATLAB programming assignments, MATLAB I/O, stochastic models, project plan, overview and requirements, accuracy and precision in modeling, MATLAB conditional statements, MATLAB loops, MATLAB functions. Use of simulation tools link Simulink. Descriptive statistics, frequency distribution, populations and sample, central tendency, variance data sampling, mean, median, mode, mean deviation, percentiles etc. Probability. Binomial, poison hyper- geometric, normal distributions, etc. Statistical inference intervals, tests hypothesis and significance. Regression and correlation

FEG 221: Engineer-in-Society.
Course Learning Outcomes (CLOs) **At the end of the course the students should be able to:**
differentiate between science, engineering and technology, and relate them to innovation;

distinguish between the different cadres of engineering – engineers, technologists,
technicians and craftsmen and their respective roles and competencies;
identify and distinguish between the relevant professional bodies in engineering;
categorise the goals of global development or sustainable development goals (SDGs); and
identify and evaluate safety and risk in engineering practice.
Course content Introduction to science, technology and engineering: The meaning of science, engineering and technology; relationships between science, engineering and technology, historical development of science, engineering and technology; the engineering as an artist and as a scientist. The Engineering family; branches of engineering technology & career opportunities; engineering education & training in Nigeria, ethical and legal considerations in engineering practice. Man & his energy sources, appropriate technology and technology transfer: safety in engineering practice: pollution and environment.

ENS 222: Introduction to Entrepreneurship Skill – 2 Units
Course Learning Outcomes (CLOs) **At the end of the course the students should be able to:**
determine capital requirements and ways of Raising capital for certain business;
undertake Financial planning and management of business enterprises;
develope feasibility studies of different categories of business enterprises;
identify possible business opportunities in Nigeria.
Course content Introduction to entrepreneurship and new venture creation; entrepreneurship in theory and practice; the opportunity, forms of business, staffing, marketing and the new venture; determining capital requirements, raising capital; financial planning and management; starting a new business, feasibility studies; innovation; legal issues; insurance and environmental considerations. Possible business opportunities in Nigeria.

EEE 222: Applied Electricity II – 3 Units
Course Learning Outcomes (CLOs) **At the end of the course the students should be able to:**
Apply different energy conservation measures and create social awareness on home energy management;
identify different part of electrical machines, their characteristics and uses;

carry out the measurements of electrical powers;
use three phase balanced circuits, PN junction diode, FETs, Communications, Introduction of TV, radio and Telephone system;
Course content Basic machines; DC, synchronous alternators, transformers, transistor characteristics, devices and circuits. Electrical and electrical power measurements. Three phase balanced circuits, PN junction diode, thyristor, FETs, communications, introduction of TV, radio and telephone system.

CHE 226: Fundamentals of Thermodynamics – 3 Units
Course Learning Outcomes (CLOs) **At the end of the course the students should be able to:**
describe the Basic concepts, and laws of thermodynamics and heat cycles;
state first law of thermodynamics and its applications to open and closed systems in solving engineering problems;
use the steady state flow equation (Bernoulli's equation) and applications in problem solving in Agricultural and bioresource.
Course content Basic concepts, definitions and laws. The ideal gas, heat and work. The first law of thermodynamics, applications to open and closed systems. The steady state flow equation (Bernoulli's equation) and applications. Second law of thermodynamics and heat cycles

CVE 228: Strength of Materials – 3 Units
Course Learning Outcomes (CLOs) **At the end of the course the students should be able to:**
recognise a structural system that is stable and in equilibrium;
determine the stress-strain relation for single and composite members based on Hooke's law;
estimate the stresses and strains in single and composite members due to temperature changes;
evaluate the distribution of shear forces and bending moments in beams with distributed and concentrated loads;
determine bending stresses and their use in identifying slopes and deflections in beams;
use Mohr's circle to evaluate the normal and shear stresses in a multi-dimensional stress system and transformation of these stresses into strains;
evaluate the stresses and strains due to torsion on circular members; and
determine the buckling loads of columns under various fixity conditions at the ends.

Course content 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.

FEG 293: Student Workshop Experience (1 Unit)
Course Learning Outcomes (CLO): **By the end of this course, students should be able to**
2. 1. demonstrate practical knowledge and skills in general engineering, including the operation of hand and powered tools for wood and metal cutting and fabrication.
3. 2. demonstrate a strong understanding of safety protocols and guidelines for using tools and machines, ensuring a safe working environment for themselves and others.
4. 3. apply their knowledge and skills in using tools and machines to complete selected engineering tasks.
5. 4. develop familiarity with various techniques and practices involved in general engineering, demonstrating the ability to select appropriate tools, cut materials, and fabricate components.
6. 5. developed problem-solving abilities in real-world engineering scenarios.
7. Course Content 8. Laboratory investigation and report submission for selected experiments and projects in 9. Thermodynamics, Applied Mechanics and Applied Electricity and Fundamental of fluid mechanics 10.

ENS 311: Entrepreneurship Practicum – 2 Units	
Course Learning Outcomes (CLOs) **At the end of the course the students should be able to:**	**POs**
understand the overview and general concept of entrepreneurship, including its role in fostering natural economic growth and its relevance to youth entrepreneurship development.	6
analyze the characteristics of entrepreneurship and develop an entrepreneurial spirit through effective training methods and	6

initiatives.	
apply creative thinking and problem-solving techniques to generate and develop innovative business ideas.	2
utilize effective business decision-making techniques to evaluate options and make informed choices in entrepreneurial ventures.	11
demonstrate the ability to identify business opportunities, develop comprehensive business plans, effectively manage businesses, and navigate the specific challenges to entrepreneurship development in nigeria.	2, 3, 9
Course content Profiles of business ventures in the various business sectors such as: Soap/Detergent, Toothbrush and Toothpast making; hotography; Brick making; Rope making, Brewing; Glassware production/ceramic production, paper production; water treatment/conditioning/packaging; food processing/preservation/packaging, metal fabrication, training industry; vegetable oil extraction; farming; fisheries/aquaculture; plastic making; refrigeration/Air-conditioning; carving, weaving, bakery; tailoring, printing, carpentry, interior decoration, animal husbandry etc. case study methodology applied to the development and administration of cases that bring out key issues of business environment, start up, pains and gains of growth of businesses, etc. with particular reference to Nigerian businesses. Experience sharing by business actors in the economy with students during	

FEG 321: Engineering Mathematics III – 3 Units	
Course Learning Outcomes (CLOs) **At the end of the course the students should be able to:**	**POs**
apply laplace transforms to find solutions for a variety of common functions and use them to solve differential and simultaneous equations in engineering problems.	1, 2, 5
analyze and apply fourier series to study periodic phenomena, enabling the understanding and prediction of periodic signals in engineering applications.	1, 2
utilize the jacobian tensor and transformation techniques to describe and analyze the behavior of multidimensional systems in engineering problems.	1, 2, 3
apply numerical analysis methods, including operational methods and special functions, to approximate solutions for complex engineering problems, ensuring accuracy and efficiency.	1, 2, 4, 5.
implement euler and runge-kutta techniques to numerically solve differential equations, demonstrating the ability to model and	1, 2, 5

simulate engineering systems accurately.	
Course Content Laplace transforms of common functions, solution of differential and simultaneous equations, Fourier series, Jacobean tensor, transformation. Numerical analysis and its application to engineering problems, operational methods, special function in engineering. Euler and Runge Kuta techniques.	

MME 341: Manufacturing Technology - 2 Units	
Course Learning Outcomes (CLOs) **At the end of the course the students should be able to:**	**POs**
11. understand the fundamental concepts of metal deformation and the factors influencing the behavior of metals during forming processes	12. 1, 2 13.
14. analyze and evaluate various forming processes, such as forging, extrusion, wire drawing, rolling, sheet metal forming, and machining, from both analytical and applied perspectives	15. 1, 2, 4
16. demonstrate proficiency in the operation and utilization of drilling, boring, grinding, and other material processing machines, including lathe/milling, bending, pressing, and rolling machines	17. 1, 5, 9
18. apply manufacturing considerations, such as tolerance analysis and the determination of fillet radius, in the design and fabrication of engineering components and structures	19. 1, 3, 4, 6
20. develop a comprehensive understanding of wood product engineering, including the properties of wood, wood processing techniques, and the design considerations for wood-based products	21. 1, 2, 5, 7
22. apply theoretical knowledge and practical skills to solve real-world engineering problems related to metal forming processes and wood product engineering, incorporating critical thinking and analysis	23. 1, 2, 3, 11, 12
24. Course content 25. An introduction to metal deformation concepts followed by a study of various forming processes from both the analytical and applied viewpoints. Processes to include the following fabrication methods: Forging, Extrusion, wire drawing, rolling, sheet metal forming, machining. Use of drilling, boring, grinding and other material processing machines (lathe/milling, bending, Pressing and rolling machines). Manufacturing consideration in design-tolerance, fillet radius e.t.c. Introduction to wood product engineering.	

Welding and Joining Technology	
Course Learning Outcomes (CLOs) **At the end of the course the students should be able to:**	**(POs)**
26. demonstrate knowledge and understanding of various types of welding processes, including fusion and non-fusion methods such as electric arc, resistance, and gas welding	27. 1, 4 28.
29. analyze the historical development of welding and its significance in industrial applications, highlighting the advancements and innovations in welding techniques over time	30. 1, 4, 6
31. apply different welding processes and techniques, including joint design and the identification of various types of welding joints, to create strong and durable welds in different materials and applications	32. 1, 3, 4, 9 33.
34. interpret welding specifications, including understanding welding positions, electrode classifications and coding, welding symbols, and quality control measures, to ensure compliance with industry standards and specifications	35. 1, 4
36. evaluate the structures of welds and the heat affected zone (haz), considering their impact on the integrity and performance of welded joints, and apply appropriate destructive and non-destructive tests to assess weld quality and detect any potential defects or flaws	37. 1, 4, 9
38. understand the principles and applications of brazing and soldering processes, including knowledge of brazing alloys, fluxes, and atmospheres, as well as soldering alloys and techniques, for joining and repairing metal components in various industries and applications	39. 1, 6, 9
40. Course content 41. Types of Welding processes-: Fusion and Non fusion; electric arc, resistance and gas welding. Historical development of welding. Welding processes and Techniques; joint design, types of welding joints. Welding specifications, welding positions. Welding electrodes: electrode coating constituents and their functions. Classifications and coding of electrodes.Welding symbols. Quality control in welds. Destructive and Nondestructive Tests. Structures of welds and Heat Affected Zone (HAZ). Types of brazing, brazing alloys, brazing fluxes and atmosphere. Soldering process; soldering alloys and their applications of soldering techniques.	

MME 321: Transport Phenomenon in Metallurgy - 2 Units	
Course Learning Outcomes (CLOs) **At the end of the course the students should be able to:**	**(POs)**

42. discuss the principles of energy transport, including fourier's law of heat conduction, and the temperature and pressure dependence of thermal conductivity in gases, liquids, and solids.	43. 1, 6
44. analyze and apply the theory of thermal conductivity to explain the heat transfer mechanisms in gases, liquids, and solids, as well as the temperature distributions in solids and laminar flow systems.	45. 1, 2, 6 46.
47. evaluate the concepts of energy transport by radiation and convection, and their applications in various metallurgical processes, such as melting and heat treatment furnaces, ore roasting, sintering, and pelletizing plants, and heat flow in solidification of castings.	48. 1, 3, 4, 6, 7 49.
50. comprehend the mechanisms of mass transport, including diffusion, and its applications in liquid and solid metals, as well as the simultaneous heat and mass transfer phenomena.	51. 1, 4, 6 52.
53. investigate thermal diffusion, pressure diffusion, and forced diffusion, and their implications in heat and mass transfer in metallurgical processes, especially in the solidification of poly-phase alloys.	54. 1, 4, 5, 6
55. Course content 56. Energy Transport: Fourier's law of Heat conduction; temperature and pressure dependence of thermal conductivity in gases and liquids; theory of thermal conductivity of gases and liquids; thermal conductivity of solids; temperature distribution in solids and in laminar flow; temperature distributions with more than one independent variable; energy transport by radiation and convection. Application of energy transport in melting and heat treatment furnaces, ore roasting, sintering and pelletizing plants, heat flow in solidification of castings. Mass Transport: Diffusion and the mechanisms of mass transport; mass transport in liquid and solid metals; simultaneous heat and mass transfer; thermal diffusion, pressure diffusion, forced diffusion; applications of heat and mass transfer in metallurgy, heat and mass transfer mechanisms in solidification of poly-phase alloys.	

MME 363: Thermodynamics of Materials - 2 Units	
Course Learning Outcomes (CLOs) **At the end of the course the students should be able to:**	**POs**
57. discuss in-depth the essential concepts of thermodynamics, including the zeroth, first, second, and third laws of thermodynamics, and their application to materials.	58. 1, 6
59. analyze and interpret thermodynamic properties such as enthalpy of reaction, entropy, and free energy, including gibbs free	60. 1, 2, 6

energy and helmholtz free energy, to predict and understand the behavior of materials in various thermodynamic processes.	61.
62. apply thermodynamic data and principles to predict the stability of phases in aqueous and high-temperature systems, utilizing techniques such as partial pressure diagrams, eh-ph diagrams, and temperature-composition diagrams.	63. 1, 3, 6, 7
64. analyze the activities and equilibrium of slag-metal and gas-metal systems, considering the interactions and equilibria between different phases in metallurgical processes.	65. 1, 4, 6 66.
67. apply the clausius-clapeyron equation to understand phase transitions and changes in equilibrium conditions as a function of temperature and pressure, and utilize this knowledge in materials and metallurgical applications.	68. 1, 5, 6 69.
70. Course content 71. Essential concepts of thermodynamics; Zeroths/First/second/third laws of thermodynamics; enthalpy of reaction; Entropy; Free Energy; Gibbs free energy and Helmholtz free energy; The Clausius Clapeyron equation. Application of thermodynamic data to predict stable phases in aqueous and high-temperature systems. Construction and use of partial pressure diagrams, Eh-pH diagrams, temperaturecomposition diagrams in related mineral and metallurgical systems. Activities and equilibrium slag-metal and gas-metal systems.	

MME 361: Physical Chemistry of Materials - 2 Units	
Course Learning Outcomes (CLOs) **At the end of the course the students should be able to:**	**POs**
72. understand the chemical properties, structure, and bonding of solids, and their relevance to materials engineering.	73. 1, 6 74.
75. analyze and apply chemical kinetics and rate processes to understand the behavior and transformations of materials in various processes, including flow sheeting, reactor design, materials/metals processing, and their impact on the environment.	76. 1, 2, 4, 7 77.
78. apply principles of phase equilibria in one-component systems, including the behavior of solutions, fugacity, activity, and equilibrium constants, such as raoult's and henry's laws, as well as the gibbs-duhem equation.	79. 1, 3, 6
80. utilize thermochemistry to analyze and interpret typical metallurgical reactions, including their graphical representations of equilibria, understanding of heterogeneous equilibrium, behavior of solutions, standard states, and electrochemical	81. 1, 4, 6 82.

thermodynamics.	
83. apply principles of physical chemistry to materials engineering, making informed decisions in the design, selection, and optimization of materials and processes, considering their chemical and thermodynamic behavior.	84. 1, 3, 5, 6 85.
86. Course content 87. Chemical properties, structure and bonding of solids, chemical kinetics and rate processes. Application of chemistry principles to materials engineering through flow sheeting, reactor design, materials/metals processing and the environment. Phase equilibria in one component systems; Behaviour of solutions –fugacity, activity and equilibrium constant –Raoults-Henry`s laws; Gibbs Duhem equation. Thermo-chemistry applied to typical metallurgical reactions, graphical representations of equilibria, heterogeneous equilibrium, behaviour of solutions, standard states, and electrochemical thermodynamics.	

MME 309: Fuels, Furnaces and Refractories - 2 Units	
Course Learning Outcomes (CLOs) **At the end of the course the students should be able to:**	**POs**
88. understand the manufacture and service characteristics of acid, basic, and neutral refractories, and their application in furnaces in relation to their working parameters.	89. 1, 2
90. analyze the sio2-al2o3 system and various refractory minerals, fluxes, and compounds like feldspar and spinel, examining their properties and their role in refractory applications.	91. 1, 2
92. evaluate the features, processes, and classification of furnaces, including the understanding of heat circulation and furnace efficiency.	93. 1, 3, 7
94. study different furnace types, such as blast furnaces, electric arc furnaces, cupola furnaces, converters, etc., including their design, operation, and applications in metallurgical processes.	95. 1, 3, 11
96. examine the composition, properties, and combustion of metallurgical fuels, including solid, liquid, and gaseous fuels, and perform calculations related to fuel combustion.	97. 1, 2, 4, 5
98. understand the principles of temperature measurement and temperature control in furnaces, including the techniques used for accurate temperature monitoring and regulation in metallurgical processes.	99. 1, 2, 6

100. Course content 101. Mineralogy: manufacture and service characteristics of acid, basic and neutral refractories; application in furnace; working parameters of refractories; the SiO2-Al2O3 system, refractory minerals, fluxes, feldspar, spinel, etc. Furnaces: features and processes; classification; heat circulation in furnaces and furnace efficiency. Furnace types: blast furnace, electric arc furnace, cupola furnace, converters, etc. The metallurgical fuels: solid, liquid and gaseous fuels. The composition and properties of metallurgical fuels; Combustion of metallurgical fuels, calculations in combustion of fuels. Principles of temperature measurement, temperature control in furnace.

MME 305: Engineering Communication - 2 Units	
Course Learning Outcomes (CLOs) **At the end of the course the students should be able to:**	**POs**
102. develop proficiency in using professional english language for writing letters, ensuring effective communication and proper tone in professional correspondence.	103. 10
104. master the art of writing specification descriptions, providing clear and concise details about technical requirements, standards, and specifications for various engineering projects.	105. 3
106. learn how to effectively present charts, graphs, and tables in a professional manner, ensuring clarity and proper interpretation of data and information.	107. 5, 10
108. acquire skills in writing proposals for reports, including the ability to clearly articulate project objectives, scope, methodology, timeline, and budget, while maintaining a professional tone.	109. 10, 11
110. analyze and present case studies of major engineering designs and construction/fabrication projects, highlighting successful examples and identifying lessons learned from industrial failures, employing professional writing techniques.	111. 2, 6, 12
112. develop professional presentation skills for delivering reports and proposals, including effective use of visual aids, concise and persuasive language, and confident delivery to engage and communicate with stakeholders.	113. 6, 10, 11
114. Course content 115. Professional use of English Language for letters, specification descriptions, presentation of charts, graphs, tables, writing of proposals in reports. Case studies of major engineering designs and construction/fabrication as well as industrial failures, professional	

presentation of reports and proposals.

FEG 322: Engineering Mathematics IV – 3 Units	
Course Learning Outcomes (CLOs) **At the end of the course the students should be able to:**	**POs**
use Mathematical tools in solving complex Engineering mathematical problemes.	
employ Simple approach in Solving Numerical integration, Laplace transformation , various level of differential equations.	
explain and Calculate Sturm-Liouville Boundary value problems and Fouries Series Partial Differential Equation.	
discuss and Solve Linear, Homogenous and Partial differential equations of 9th order with Constant Coefficients.	
explain and use different techniques in solving Integral Transforms .	
Course content Vector analysis; operator, line and Gaus theorem, numerical integration and differentiation, derivatives of complex variables; mathematical modelling of physical systems, boundary value problems. Partial differentiation equation including theory, classification and solution by various methods. Fourier integral and series.	

MME 342: Foundry Theory and Practice - 2 Units	
Course Learning Outcomes (CLOs) **At the end of the course the students should be able to:**	**POs**
understand the basic definitions and fundamental concepts of foundry practice, including metal casting and sand casting.	1, 6, 10
demonstrate knowledge of the design principles and techniques for castings, molds, and cores in foundry processes.	1, 3, 6
evaluate the quality and characteristics of foundry sand and its impact on casting outcomes.	1, 6, 7
analyze the solidification mechanism, including nucleation and rate of cooling, in metal casting.	1, 2, 6
apply the principles of riser and gating system design and placement for efficient casting production.	1, 2, 6
assess the interaction between the mold and molten metal, identify and address casting defects, and understand the stress-	1, 2, 4, 6,

strain relations and casting properties of metals and alloys. additionally, analyze the economic efficiency of different casting methods and the importance of heat treatment in the casting process.	11
Course content The basic definitions in foundry. Fundamentals of metal casting; Sand casting: molding materials (binders, e.t.c.), mold production, core making and pattern construction. Design of castings, molds and cores. Quality and characteristics of foundry sand. Introduction to casting of steel, cast iron, copper and aluminum based alloys. Solidification mechanism: nucleation and rate of cooling. Riser and gating systems: design/placement. Interaction of the mold with molten metal. Gases in casting, casting defects. Stress-strain relations in casting; casting properties of metals and alloys: Fluidity, shrinkage and segregation. Charge calculation. Heat treatment of casting. Types of casting methods: Metal/Permanent mold casting, die casting, investment casting and centrifugal casting. Economic efficiency of a casting process.	

`MME 324: Engrg Mats: Structure Ppties and Heat/Treat	
Course Learning Outcomes (CLOs) **At the end of the course the students should be able to:**	**POs**
understand the basic structure of metals, ceramics, polymers, metallic alloys, and composites, and their relationship to mechanical, electrical, magnetic, optical, thermal, and chemical properties.	1, 6
identify and explain the principles and processes involved in heat treatment and phase transformations of materials.	1, 4, 6, 12
analyze the structures and properties resulting from various heat treatments, including the formation of austenite, pearlite, bainite, and martensite in steel.	1, 4, 6, 11
evaluate the decomposition of austenite, continuous cooling, isothermal transformation, cooling curves, and ttt diagrams.	1, 4, 6
apply knowledge of quenching, hardenability, tempering, austempering, martempering, annealing, and normalizing processes to achieve desired material properties.	1, 3, 6
describe the structure, properties, and heat treatment considerations of important commercial alloys such as aluminum, copper, titanium alloys, cast irons, stainless steels, tool steels, and nickel, nickel-iron, and cobalt superalloys.	1, 3, 6, 11

Course content Basic structure of metals, ceramics, polymers, metallic alloys, and composites. Relationships between the structure of materials and their mechanical, electrical, magnetic, optical, thermal, and chemical properties. Introduction to heat treatment and phase transformations. Structures and properties resulting from the various heat treatments. Formation of austenite, pearlite, bainite and martensite in steel. Decomposition of austenite, continuous cooling, isothermal transformation, cooling curves and TTT diagrams. Quenching, Hardenability and Tempering; Austempering, Martempering, Annealing and Normalizing processes. Austenite grain size and cooling correlations. Basics of supersaturation and precipitation. Structure, properties and heat treatment of other important commercial alloys – Aluminium, Copper and Titanium Alloys; Cast Irons; Stainless Steels; Tool Steels; and Nickel, Nickel–Iron and Cobalt superalloys.

MME 362: Mineral Processing - 2 Units	
Course Learning Outcomes (CLOs) **At the end of the course the students should be able to:**	**POs**
understand the origin and formation of mineral deposits and identify the principal ores of common metals.	1, 6, 7
apply theoretical principles and practical techniques of comminution and liberation in crushing and grinding processes, including the selection and limitations of equipment.	1, 2, 5, 10
explain the principles of sizing and classification in mineral processing, including the use of laboratory and industrial equipment, settling of solids in fluids, and various types of classifiers.	1, 3, 5, 10
evaluate gravity concentration methods, such as jigging, spirals, tables, and heavy media separators, and their application and limitations. understand the physicochemical principles of froth flotation and its application in the flotation of simple ores. describe the use of electrostatic and electromagnetic methods of concentration.	1, 3, 5, 10
analyze the theory and practice of dewatering and drying in mineral processing, including thickening, filtration, and drying processes. understand the principles of coal/washing, including coal/shale separation and coal flotation and cleaning.	1, 3, 5, 7
interpret simplified flow sheets for the beneficiation of simple ores of copper, tin, lead, zinc, iron, gold, and other locally important ores.	1, 3, 5, 11
Course content	

Introduction: Origin and formation of mineral deposits. Principal ores of common metals. Discussion of the mineral wealth of Nigeria, their location and type. Scope, objects and limitations of mineral dressing.
Comminution and Liberation: Theory and practice of crushing and grinding. Typical equipment used, their field of application and limitations.
Sizing and Classification: Principle of sizing and classification, equipment used for Laboratory and industrial sizing, law of settling of solids in fluids, types of classifiers, classification as a means of sizing and concentration.
Concentration: Gravity concentration methods using jig, spirals, tables, and heavy media separators. Application and limitations of each method. Froth flotation and physicochemical principles involved therein. Flotation machines and flotation of simple ores. Electrostatic and electromagnetic methods of concentration.
Dewatering and Drying: Theory and practice of thickening, Filtration and Drying.
Coal/Washing: Coal/shale separation, coal flotation & Cleaning.
Flow sheets: Simplified flow sheets for the benefication of simple ores of copper, tin, lead, zinc, iron, gold, and other ores of local importance.

MME 352: Mechanical Metallurgy I - 2 Units	
Course Learning Outcomes (CLOs) **At the end of the course the students should be able to:**	**POs**
apply stress-strain relations to determine principal stresses, strains, and directions using the mohr circle and strain gauges	1, 2, 5, 10
analyze elastic and plastic deformation in single crystals and polycrystals, including plastic yield criteria	1, 2, 5
describe the concepts of dislocations, dislocation density, and dislocation motion and their role in material deformation	1, 2, 5
explain the various deformation mechanisms in metals, such as slip, twinning, grain boundary sliding, creep, and stress rupture	1, 2, 5
evaluate the analytical and applied perspectives of metal deformation processes, including forging, rolling, extrusion, stamping, wire drawing, and sheet metal forming	1, 3, 5, 10
assess the effects of cold working, hot working, and annealing on the mechanical and physical properties of materials	1, 3, 5, 7

Course content
Mechanical behaviour of materials. Stress-strain diagrams for ductile and brittle metals. Stress–strain relations; principal stresses, strains and directions; the Mohr Circle; strain gauges. Elastic and Plastic deformation, Plastic Deformation of single crystals and polycrystals; Plastic Yield Criteria. Introduction to dislocations, dislocation density, and dislocation motion. Metal Deformation processes; deformation mechanisms of slip, twinning, grain boundary sliding, creep and stress rupture. Forging, Rolling, Extrusion, Stamping, Wire Drawing, and Sheet Metal forming processes – analytical and applied perspectives. Effects of cold working, hot working, and annealing on mechanical and physical properties, Strengthening mechanisms in metals and alloys.

MME 332: Physical Metallurgy 1 - 2 Units	
Course Learning Outcomes (CLOs) **At the end of the course the students should be able to:**	**POs**
understand crystal structure and the concept of crystallographic planes and directions. apply miller indices to describe crystallographic orientations.	1, 5, 10
identify and analyze imperfections and defects in crystalline materials, including vacancies, interstitials, dislocations, and grain boundaries.	1, 4, 6
explain the role of dislocations in plastic deformation and strain hardening of materials.	1, 2, 5
describe diffusion in solids and apply fick's 1st and 2nd laws of diffusion. differentiate between interstitial and substitutional diffusions.	1, 4, 5
analyze phase equilibria and equilibrium diagrams for pure metals and alloys. understand the vapor-liquid and liquid-solid solidification processes.	1, 4, 7
explore solid-state transformations, including nucleation, cellular, and displasive transformations.	1, 4, 7
examine precipitations from solid solutions, recovery, recrystallization, and grain growth. understand the interfaces and interfacial reactions in liquids and solids.	1, 4, 6
Course content Crystal structure; crystallographic planes and directions. Miller indices. Imperfections and defects in crystalline materials. Introduction to dislocations and their roles in plastic deformation and strain hardening. Introduction to diffusion in solids, Fick’s 1st and 2nd law of diffusion, interstitial and substitutional diffusions. Phase equilibria and equilibrium diagrams. Phase transformations: vaporliquid and liquid-solid solidification processes for pure	

metals and alloys. Solid state transformation, nucleation, cellular and displasive transformations. Precipitations from solid solutions, recovery, recrystallization and grain growth. Interfaces and interfacial reactions in liquids and solids.

MME 395: Laboratory Practical I (2 units C: PH 90)	
Course Learning Outcomes (CLOs) **At the end of the course the students should be able to:**	**POs**
demonstrate fabrication methods such as forging, extrusion, rolling, sheet metal forming	1, 3, 5, 9
show how orthogonal & oblique cutting are carried out on a lathe	1, 3, 5, 9, 10
calculate machining time for cylindrical turning on a lathe	1, 2, 3, 4, 5, 9, 10
welding and brazing joints (using arc, mag, brazing) and evaluate the heat-affected zone of a weldment (macro and micro examination)	1, 2, 4, 5, 9, 10
explain the melt mass flow rate (mfr) of engineering materials	1, 2, 6, 9
evaluate the calorific value of coke using a bomb calorimeter, proximate analysis of coal and coke	1, 4, 5, 9
Course content Study the crystal structure of a given specimen (BCC, FCC, HCP), to study the imperfection in crystal, to study the solidification curve of given metal, to study heat treatment processes (annealing, normalizing, hardening & tempering) applied to a given specimen, to study the microstructure of mild steel with the help of microscope. Demonstration of comminution devices, demonstration of operation of a pneumatic conveying system for solids and to show how a cyclone is used to separate the solids from the air stream. Introduction to different types of screening equipment. Demonstrate of manufacturing/ fabrication techniques: forging, extrusion, rolling, sheet metal forming, study of Orthogonal & Oblique Cutting on a Lathe, calculate the machining time for cylindrical turning on a Lathe and compare with the actual machining time. Demonstration of welding and joining processes and welding metallurgy. Determination of the thermal conductivity of a metallic rod, to determine the thermal conductivity of an insulating power, to determine the thermal conductivity of a solid by the guarded hot plate method, to verify the Stefen-Boltzmann constant for thermal radiation.	

Determination the calorific value of coal using Bomb Calorimeter, to determine the calorific value of coke using Bomb Calorimeter, proximate Analysis of coal and coke.

MME 390: SIWES II – 3 Units

Third year student vacation programme.

400 LEVEL MME

MME 441: Synthesis, Processing, and Manufacturing of Materials - 2 Units	
Course Learning Outcomes (CLOs) **At the end of the course the students should be able to:**	**POs**
demonstrate a comprehensive understanding of the composition, structure, and properties of principal alloy, ceramic, and polymer systems	1, 5, 6, 7, 12
analyze and evaluate the effects of different processing techniques on the physical and mechanical properties of materials	1, 2, 3, 4, 5, 6, 7, 10
apply design fundamentals to the selection of materials and the examination of material/design case studies for manufacturing applications	1, 2, 3, 4, 6, 10
investigate the relationship between processing methods and material properties to optimize manufacturing processes and improve material performance	1, 2, 3, 4, 5, 6, 7, 10, 11
demonstrate proficiency in analyzing and interpreting data related to the effects of processing on material properties	1, 2, 3, 4, 5, 6, 7, 10
develop critical thinking and problem-solving skills by proposing innovative approaches to synthesis, processing, and manufacturing of materials	1, 2, 3, 4, 5, 6, 9, 11, 12
Course content Detailed study of principal alloy, ceramic, and polymer systems. Evaluation of the effects of processing on selected physical and mechanical material properties. Overview of design fundamentals and examination of selected material/design case studies for manufacturing.	

MME 463: Extractive Metallurgy 1 - 2 Units	
Course Learning Outcomes (CLOs) **At the end of the course the students should be able to:**	**POs**
understand the principles of current hydrometallurgical practices in mineral processing, metal extraction, and recovery	1, 5, 6, 7, 12

apply thermodynamics and kinetics principles to analyze and evaluate hydrometallurgical processes, including leaching, solvent extraction, and ion exchange	1, 2, 3, 4, 5, 6, 7, 10
demonstrate knowledge of the extractive metallurgy of rare earth metals, including their extraction and refining processes	1, 2, 3, 4, 6, 10
identify and describe the extractive metallurgy processes for nonferrous metals native to nigeria, such as tin, columbite, gold, lead, and others	1, 2, 3, 4, 5, 6, 7, 10, 11
analyze the environmental and economic aspects of hydrometallurgical processes in extractive metallurgy and propose sustainable solutions	1, 2, 3, 4, 5, 6, 7, 10
clo 6: apply critical thinking and problem-solving skills to address challenges and emerging technologies in hydrometallurgy for mineral processing and metal extraction	1, 2, 3, 4, 5, 6, 9, 11, 12
Course content Current hydrometallurgical practice as applied to mineral processing, metal extraction, and recovery; recent developments in technology, thermodynamics and kinetics of hydrometallurgical processes; leaching, solvent extraction and ion exchange. Extractive metallurgy of rare earths metals. Extractive metallurgy of nonferrous metals (especially those native in Nigeria) – tin, Columbite, gold, lead, etc.	

MME 475: Laboratory Practical II (2 Units C: PH 90)	
Course Learning Outcomes (CLOs) **At the end of the course the students should be able to:**	**POs**
explain the relationship between engineering stress and engineering strain according to the results obtained from tensile tests and hence obtain graphically the tensile strength or ultimate tensile strength, yield stress, and offset yield (proof) stress.	1, 2, 4, 5, 6, 10
identify machines used to measure hardness, toughness, ductility, etc., and how they function.	1, 2, 5, 6, 10
produce specimens for ductility, hardness, toughness, etc., tests and carry out these tests on them.	1, 2, 4, 5, 6, 10
conduct corrosion experiments and calculate corrosion rate through the weight loss method.	2, 4, 5, 6, 7, 10
deduce physical and mechanical properties of materials from data generated from xrd, sem, eds, etc.	1, 2, 4, 5, 6, 10
observe the behavior of any material under compression conditions (press or scratch).	1, 2, 4, 5, 6, 10

Course content Testing of moulding and core sand; permeability, cohesiveness or strength, adhesiveness, plasticity, refractoriness, binding, chemical resistivity, flowability. Sieve analysis to find grain fineness number of base sand; to find the distribution of sand grains using a set of sieves and to find the average grain fineness number. Clay content test; to determine the percentage of clay present in base sand. Core and core making, introduction and use of moulding tools & equipment. Practical demonstration of sand and permanent mould casting processes. Solid Pattern; calculation for solid Pattern. Study and demonstration of mechanical properties; ultimate tensile strength, 0.2% proof strength, flexural, ductility, toughness strength, hardness, creep and fatigue strength of selected materials. Engineering Materials' qualitative and quantitative analysis using X-ray diffractometer, X-ray flouresence, Auger electron spectroscopy, Electron microprobe analysis etc. thermal analysis; Differential Thermal Analysis, Thermo-Gravimetric Analysis and Differential scanning calorimetry (DTA, TGA, DSC). Study and demonstration of effects of production techniques (e.g, stir casting) and reinforcement orientation, percentage and size on the properties of selected composite materials (MMCs & PMCs). Study and demonstration of mechanism of corrosion and its protection. Study and evaluation of corrosion rate in various media by electrochemical and gravimetric methods.

MME 451: Material Engineering Design - 2 Units	
Course Learning Outcomes (CLOs) **At the end of the course the students should be able to:**	**POs**
apply physical, chemical, and mechanical principles to design devices, components, and systems	1, 2, 3, 5, 9, 10, 11
utilize computer-based design tools, such as powerpoint and matlab, to analyze problems and develop solutions	1, 2, 4, 5, 9, 10
incorporate economic and ethical principles in the design process, considering cost analysis and sustainability	: 1, 2, 3, 6, 7, 8, 10
demonstrate effective communication skills through oral and written presentations of design concepts and solutions	1, 4, 5, 10
work collaboratively in teams, demonstrating shared responsibility and teamwork in the design and development of devices and systems	: 1, 5, 9, 10
Course content Design of devices: common solid-state devices and mechanical systems; components (engine block, crank shaft, ball bearing e.t.c.), processes or systems using physical, chemical, mechanical, economic and ethical	

principles. Project planning and cost analysis. Application of computer-based design tools: Power Point, Matlab. Analysis of problems, design and development of solutions. Concepts of shared responsibility, teamwork and communication. Oral and written presentations.

MME 471: Corrosion Science and Engineering - 3 Units	
Course Learning Outcomes (CLOs) **At the end of the course the students should be able to:**	**POs**
understand the theories of corrosion and classify corrosion into different types based on fundamental causes	1, 2, 4, 6
analyze electrochemical reactions involved in corrosion processes and apply knowledge to predict corrosion rates and prevent corrosion	1, 2, 4, 5, 8
evaluate and select corrosion prevention methods and materials based on their effectiveness in different environments	1, 3, 4, 5, 7
apply principles of basic chemistry, electrochemistry, and thermodynamics to explain corrosion phenomena and passivity in materials	1, 2, 4, 6
investigate case studies of corrosion in various materials, such as stainless steel and cast iron, to identify common corrosion problems and failures	1, 4, 5, 9, 10
demonstrate knowledge of corrosion testing, monitoring, and control techniques, including cathodic and anodic protection methods	1, 2, 5, 10
Course content Theories of corrosion and classification into eight basic types; fundamental causes of corrosion problems and failures. Emphasis is placed on the electrochemical reactions occurring and the tools and knowledge necessary for predicting corrosion, measuring corrosion rates, and combining these with prevention and materials selection; Corrosion inhibition. Review of basic chemistry, electrochemistry and thermodynamic functions related to corrosions; transport phenomena and passivity. Case studies of the corrosion of various materials – stainless, cast iron etc.Corrosion testing, monitoring and control; cathodic and anodic protection.	

MME 403: X-ray Diffraction & Analytical Techniques – 2 Units	
Course Learning Outcomes (CLOs) **At the end of the course the students should be able to:**	**POs**
understand the principles of x-ray diffraction and its application	1, 4, 5,

in crystallography for the determination of crystal structures	10
analyze the bragg law and its significance in x-ray diffraction experiments for studying crystal structures and obtaining information about lattice parameters	1, 4, 5
utilize various x-ray diffraction methods, including the laue, rotating crystal, and debye-scherrer powder methods, for crystal structure analysis	1, 3, 4, 5
operate diffractometers, spectrometers, and counters, and apply counting ratemeter and scalar circuits in x-ray diffraction experiments	1, 5, 10
apply fluorescent x-ray spectroscopy for chemical analysis using diffraction and spectroscopic methods and understand the principles behind these techniques	1, 4, 5, 10
demonstrate knowledge of various electro-optical techniques for microstructural examination, such as Transmission Electron Microscope (TEM), Scanning Electron Microscope (SEM), Scanning Tunneling Microscope (STM), and Atomic Force Microscope (AFM)	1, 5, 10
understand other analytical techniques, including Secondary Ion Mass Spectroscopy (SIMS), Rutherford Backscattering Spectroscopy (RBS), Auger Electron Spectroscopy (AES), Energy Dispersive X-ray Spectroscopy (EDS or EDX), X-ray Photoelectron Spectroscopy (XPS), and Atomic Absorption Spectrophotometry (AAS)	1, 4, 5

Course content

X-rays as part of the electromagnetic spectrum. X-rays and crystallography. Wavelength, frequency and energy of radiations. Absorption of X-rays. The Bragg Law. The Laue, Rotating Crystal, and Debye-Scherrer powder methods, Crystal Structure Analysis. Diffractometers, Spectrometers and Counters; counting ratemeter and scalar circuits. Fluorescent X-ray spectroscopy. Chemical analysis by Diffraction and by fluorescent spectroscopic methods, Electro-optical Techniques for Microstructural Examination: Transmission Electron Microscope (TEM), Scanning Electron Microscope (SEM), Scanning Tunneling Microscope (STM) and Atomic Force Microscope (AFM). Transmission and Reflection Electron Diffraction (TED and RED) techniques. Introduction to other analytical techniques: Secondary Ion Mass spectroscopy (SIMS), Rutherford Backscattering Spectroscopy (RBS), Auger Electron Spectroscopy (AES), Energy Dispersive X-ray Spectroscopy (EDS, or EDX), and X-ray Photoelectron Spectroscopy (XPS); Atomic Absorption Spectrophotometry (AAS).

MME 411: Ceramics & Glass Engineering – 2 UNITS	
Course Learning Outcomes (CLOs) **At the end of the course the students should be able to:**	**POs**
understand the classifications of ceramics, including glass, clay, refractory, abrasive, and cement, and their unique properties and applications	1, 6, 7
analyze the atomic bonds and oxide structures in ceramic systems, such as caesium chloride, sodium chloride, perovskite, spinels, etc , and relate them to the properties and behaviors of ceramics	1, 5
evaluate the structures of crystalline ceramics, including silicate structures, types of silicate structures (chain silicates, sheet silicates), and the concept of polymorphism in ceramic materials	1, 4
interpret phase diagrams in ceramic systems and apply them to understand the relationships between composition, structure, and properties in ceramics	1, 4
demonstrate knowledge of clay processing and component manufacture, including the techniques involved in shaping, firing, and forming clay-based ceramics	1, 3, 5, 10
examine the constituents and functions of glass, distinguish different types of glasses (e g , pyrex, boro-silicate, fiber glass), and comprehend the properties, classifications, fabrication, and heat treatment of glasses	1, 6, 7
Course content Classifications of ceramics: glass, clay, refractory, abrasive and cement. Atomic bonds and oxide structures in ceramic systems: Caesium Chloride, Sodium chloride, Perovskite, spinels etc. Properties of ceramics materials: structures of crystalline ceramics, silicate structures, types of silicate structures, chain silicates, sheet silicates. Polymorphism. Phase diagrams in ceramic systems. Clay processing and component manufacture. Glass: constituents of glass and their functions, glass types-pyrex, boro-silicate, fiber glass, etc. Properties of glass, classifications, fabrication, heat treatment of glasses.	

MME 433: Principles of Phase Diagrams - 2 Units	
Course Learning Outcomes (CLOs) **At the end of the course the students should be able to:**	**POs**
understand the principles of phase equilibria and the gibbs phase rule for predicting and analyzing the stability of different phases in a system.	1, 4, 5, 7

analyze unary and binary phase diagrams, including isomorphous phase diagrams, to interpret the phase relationships and transformations in materials.	1, 4, 5
identify and explain the behavior and characteristics of binary systems with eutectic, eutectoid, peritectic, peritectoid, monotectic, and syntectic reactions.	1, 4, 5
evaluate the effects of coring, envelopment, and liquation on microstructure in eutectic, isomorphous, and binary systems, and understand the modification techniques for eutectic alloys.	1, 4, 5, 7
apply tie-lines and the (inverse) lever rule for determining phase compositions and proportions in binary systems, and comprehend their significance in phase transformations and equilibrium.	1, 5
introduce the concept of ternary equilibrium diagrams and their applications in understanding complex systems, and explore different methods for the experimental determination of phase diagrams.	1, 4, 5, 6
Course content Phase equilibria and the Gibb's Phase Rule. Invariant Reactions (1 to 2, and 2 to 1 types). Unary and Binary Phase Diagrams. Isomorphous phase diagrams. Phase transformations. Binary Eutectic and Eutectoid systems; Peritectic and Peritectoids ystems; Monotectic systems; Syntectic systems. Phase diagrams showing congruent transformations in alloys. Order-Disorder transformations. Coring in eutectic and isomorphous systems and its effect on microstructure. Modification of eutectic alloys. Envelopment or surrounding in peritectic alloys and its effect on microstructure. Liquation in Binary systems. Use of tie-lines and the (inverse) lever law.Ternary equilibrium diagrams and other complex systems. Methods for determination of phase diagrams.	

MME 490: SIWES III – 6 Units

Six months industrial Training for the student.

500 LEVEL MME 501:

Engineering Management – 3 Units	
Course Learning Outcomes (CLOs) **At the end of the course the students should be able to:**	**POs**
understand the principles of organization and management and apply them to effectively manage engineering projects and teams.	1, 3, 9, 11
demonstrate knowledge of financial management principles, including accounting methods, financial statements, cost planning and control, and budgeting, to make informed financial decisions	1, 4, 5, 8, 11

in an engineering context.	
apply personnel management techniques, such as selection, recruitment, training, job evaluation, and merit rating, to effectively manage human resources in engineering organizations.	1, 3, 9, 11
apply resource management principles, including contracts, interest calculations, rate of return, and economic evaluation methods, to make optimal resource allocation decisions in engineering projects.	1, 4, 5, 8, 11
apply planning and decision-making techniques, including forecasting, scheduling, production control, gantt chart, cpm, pert, and linear programming, to effectively plan and manage engineering projects and optimize resource utilization.	1, 3, 4, 5, 11
understand the principles of work study, motion economy, and ergonomics and apply them to design efficient equipment, processes, and workplace layouts in engineering settings.	1, 3, 6, 9
Course content Principles of organization; elements of organization; management by objectives. Financial management, accounting methods, financial statements, cost planning and control, budget and budgetary control. Depreciation accounting and valuation of assets. Personnel management, selection, recruitment and training, job evaluation and merit rating. Industrial psychology. Resource management; contracts, interest formulae, rate of return, methods of economic evaluation. Planning decision making; forecasting, scheduling. Production control. Gantt Chart, CPM and PERT. Optimization, linear programming as an aid to decision making, transport and materials handling. Raw materials and equipment. Facility layout and location. Basic principles of work study. Principles of motion economy. Ergonomics in the design of equipment and process.	

MME 551: Metallurgical Engineering Equipment and Plant Design - 3 Units	
Course Learning Outcomes (CLOs) **At the end of the course the students should be able to:**	**POs**
understand the fundamental concepts of metallurgical equipment and plant design.	1, 3, 5, 7, 11
identify and evaluate various metallurgical processes and their requirements.	1, 3, 4, 6, 7
evaluate different types of metallurgical equipment and their selection criteria.	1, 3, 5, 7, 9
apply design principles to optimize the performance of	1, 3, 5,

metallurgical processes and equipment.	7, 9
analyze safety considerations and risk management strategies in metallurgical plant design.	3, 6, 7, 8, 11
incorporate environmental and sustainability factors in equipment and plant design.	3, 6, 7, 8
perform economic evaluations and cost analysis for metallurgical plant design projects.	1, 3, 5, 7, 11
demonstrate effective project management and communication skills for equipment and plant design.	3, 9, 10, 11
Course content Mineral processing equipment and plant design; ore preparation equipment and plant design (sintering pelletizing, briquetting);Equipment and plant design for iron making (blast furnace and accessories), direct reduction furnaces and equipment (midrex process, co-reduction process corex process, etc), steel production (converters, open heart furnaces, electric arc furnaces, secondary steel making equipment), non-ferrous metals production; foundry (cupola, induction furnaces etc).Equipment and plant design for rolling mills, extrusion mills, drawing mills etc.	

MME565: Chemical Metallurgy - 2 Units	
Course Learning Outcomes (CLOs) **At the end of the course the students should be able to:**	**POs**
understand the thermodynamic principles governing the extraction of metals from their ores and apply them to metallurgical processes.	1, 2, 3, 4, 5, 7
analyze and apply the kinetic principles involved in various metallurgical processes, such as roasting, agglomeration, briquetting, nodulizing, pelletizing, sintering, smelting, converting, and refining.	1, 2, 3, 4, 5, 7
evaluate the oxidation and reduction processes in metallurgy and their role in the extraction and purification of metals.	1, 2, 3, 4, 5, 7
assess the techniques and methods used for desulphurization and dephosphorization in metallurgical processes and their significance in achieving high-quality metal products.	1, 2, 3, 4, 5, 7, 8
analyze the properties and functions of metallurgical slags and fluxes and their role in the refining and purification of metals.	1, 2, 3, 4, 5, 7
Course content The study of thermodynamics and kinetic principles involved in winning of metals; kinetics of roasting, agglomeration, briquetting, nodulizing pelletizing and sintering; Oxidation and Reduction processes; smelting, converting, and refining. Desulphurization and dephosphorization. Metallurgical slags and fluxes.	

MME 553: Powder Metallurgy - 2 Units	
Course Learning Outcomes (CLOs) **At the end of the course the students should be able to:**	**POs**
explain the meaning of powder metallurgy and appreciate the numerous advantages powder metallurgy has over other conventional engineering manufacturing processes.	1, 2, 3, 5, 6, 7
categorize the wide scope of powder metallurgy industry and the global market outlets available for powder metal products.	1, 2, 3, 6, 7
describe the various methods by which metal powders are produced, the nature of the powders produced, the shapes and characteristics of the individual powder particles and powder mass.	1, 2, 3, 5, 6
explain the methods of manufacturing powder products, tools and equipment employed, and the optional/secondary operations carried out on the powder products after manufacture.	1, 2, 3, 5, 6, 10
describe the criticality of design of dies to be able to handle the product during compaction to ensure easy withdrawal while retaining part geometry and shape.	1, 2, 3, 5, 6
Course content Definition of Powder Metallurgy. General outline of the PM process: raw materials, forming, sintering, optional/secondary operations, and finished product. Advantages of PM process; structure of the PM industry; and structural components markets. Metal powder production processes: mechanical, chemical/electrolytic, physico-chemical, and miscellaneous methods. Shapes of powder particles, and characteristics of metal powders. Metal powder products manufacturing procedures: mixing/blending, compaction and compaction presses; sintering and sintering furnaces and atmospheres; secondary/optional operations (sizing, densification, impregnation, infiltration, heat treats, machining, etc. Design considerations in powder metallurgy. Listing of powder metallurgy products.	

MME 513: Polymeric Materials Engineering - 3 Units	
Course Learning Outcomes (CLOs) **At the end of the course the students should be able to:**	**POs**
understand the fundamental principles of polymer chemistry and the synthesis of organic polymeric materials.	1, 2, 3, 5, 6
analyze the molecular structure of polymers and its impact on the properties and behavior of thermoplastic and thermosetting polymers.	1, 2, 3, 5, 6
evaluate the structure-property relationships in polymers and	1, 2, 3, 5,

their influence on the performance and applications of polymeric materials.	6
explore the manufacturing processes involved in the production of organic polymeric materials and their implications for material properties and performance.	1, 2, 3, 5, 6, 7
apply the knowledge of polymer chemistry and structure-property relationships to the selection and design of polymeric materials for specific applications.	1, 2, 3, 5, 6, 9, 10
Course content Introduction to the manufacture, processing, and applications of organic polymeric materials. The chemistry of polymer manufacture, the molecular structure of polymers, and the structure-property relationships for thermoplastic and thermosetting polymers are covered.	

MME 531: Physical Metallurgy II - 2 Units	
Course Learning Outcomes (CLOs) **At the end of the course the students should be able to:**	**POs**
understand phase transformations in metallic systems, including allotropy, polymorphism, and order-disorder transformations.	1, 2, 4, 5, 6, 10
analyze the formation and properties of substitutional and interstitial solid solutions, as well as intermediate phases such as intermetallic and electron compounds.	1, 2, 4, 5, 6, 10
examine diffusion theory and its application to understanding diffusion processes in metallic systems, including fick's first and second laws and the kirkendall effect.	1, 2, 4, 5, 6, 10
investigate the behavior and properties of dislocations in crystals, including dislocation theory, dislocation density, and dislocation reactions in different crystal lattices.	1, 2, 4, 5, 6, 10
evaluate the effects of dislocations on plastic deformation, strain-hardening, and the mechanical behavior of metals.	1, 2, 4, 5, 6, 10
explore the interaction of dislocations with point defects and second-phase particles, as well as the role of jogs, kinks, and dislocation multiplication in dislocation motion and lattice resistance stress.	1, 2, 4, 5, 6, 10
Course content Phase transformations in metallic systems. Allotropy or Polymorphism. Substitutional and interstitial solid solutions; the Hume-Rothery rules. Intermediate phases-Intermetallic and Electron compounds; interstitial compounds, Valency compounds and Size Factor compounds; Laves phases. Order – disorder transformations. Defect phases. Review of isothermal transformations in steels; martensitic transformation. Massive transformation. Review of diffusion theory; Fick's First and Second laws.	

Diffusion couples and phase diagrams; the Kirkendall effect. Equation of continuity; Green's function applications to diffusion. Elementary dislocation theory. Burgers vector and burgers circuit; perfect and imperfect dislocations; dislocation density. Elastic properties of dislocations. Stress and strain fields of dislocations; self energy of dislocations.
Forces on dislocations and forces between dislocations; the PeachKoehler equation. Glide, climb and cross-slip motions of dislocations. Dislocation effects on plastic deformation and strain-hardening. Dislocation reactions in crystals (in FCC, HCP and BCC lattices). Interaction of dislocations with point defects and second phase particles. Jogs and kinks in dislocations and their effect on motion. Origin and multiplication of dislocations. Lattice resistance stress- the Peierls–Nabarro stress.

MME 511: Engineering Materials Selection and Application - 2 Units	
Course Learning Outcomes (CLOs) **At the end of the course the students should be able to:**	**POs**
understand the nature of engineering materials and the criteria for materials selection in various applications.	1, 2, 3, 4, 6, 7, 8, 10, 12
analyze the properties, characteristics, and application of ceramics, composites, polymeric, and metallic materials, including steel, stainless steels, cast iron, aluminum alloys, copper alloys, silicon carbide, alumina, magnesia, and various polymers.	1, 2, 3, 4, 6, 7, 8, 10
evaluate materials selection and design considerations for specific industries and technologies, such as automotive, rail, marine, aircraft, space, construction, energy generation, and transmission.	1, 2, 3, 4, 6, 7, 10, 11
examine the properties and application of materials in magnetic, optical, electrical, thermal, and electronic designs.	1, 2, 3, 4, 6, 7, 10
understand the selection and application of alloys for specific purposes, including gear steels, automotive sheet steels, fuel production and distribution, and process industries.	1, 2, 3, 4, 6, 7, 10
apply materials selection principles to practical engineering scenarios, considering factors such as performance, cost, sustainability, and manufacturing processes.	1, 2, 3, 4, 6, 7, 8, 10, 11, 12

Course content Nature of engineering materials; criteria for materials' selection; materials for automotive, rail, marine, aircraft, space technology applications. Materials' selection and design considerations; construction materials, energy generation, transmission and distribution materials. Properties and application of ceramics, composites, polymeric and metallic materials; steel, stainless steels, cast iron, aluminum alloys, copper alloys, silicon carbide, alumina, magnesia, polyethylene, polyvinyl chloride, polymethyl methacrylate, polyesters, etc. Materials' selection and application for magnetic, optical, electrical, thermal, electronic designs. Selection and application of alloys for gear steels, automotive sheet steels, fuel production and distribution and process industries.

MME 577: Laboratory practical III 2 units	
Course Learning Outcomes (CLOs) **At the end of the course the students should be able to:**	**POs**
prepare specimen for micro examination.	
observe the grains of the specimen under microscope.	
evaluate the hardenability of steel and relate it to material selection to avoid thermal stress and distortions.	
Heat steel to appropriate temperature, and quenching using different quenching media	
List the differences between hardness and hardenability	
Carry out size analysis using laboratory sieves	
Course outline Hardenability and Jominy Test. Hardening Steel using Different Quenching Media. Tempering steel at various temperatures.Selection of materials based on hardenability Effects of sintering temperature on properties of powder metallurgy product. Effects of sintering pressure on properties (dielectric) of materials synthesized via powder metallurgy. Sample preparation for micro examination (Cutting and grinding). Sample preparation for micro examination (Polishing mounting and etching). Micro-examination of specimen of materials. Control in sinter making operation. Blast furnace burden testing. How to control sinter via coke additions. Understanding the three stages of blast furnace control. Phases in quenched and tempered steel. Sizing using laboratory sieves. Presentation and analysis of sizing results. Laboratory result and report presentation.	

MME 577: Laboratory Practical III (2 units C: PH 90)	
Course Learning Outcomes (CLOs) **At the end of the course the students should be able to:**	**POs**
prepare specimen for micro examination.	1, 2, 4, 5, 6, 9, 10
observe the grains of the specimen under a microscope.	1, 2, 4, 5, 6, 9, 10
evaluate the hardenability of steel and relate it to material selection to avoid thermal stress and distortions.	1, 2, 3, 4, 6, 7, 8, 10
heat steel to an appropriate temperature and quench using different quenching media.	1, 2, 3, 4, 5, 6, 9, 10
list the differences between hardness and hardenability.	1, 2, 4, 5, 6, 9, 10
carry out size analysis using laboratory sieves.	1, 2, 4, 5, 6, 9, 10
Course content Hardenability and Jominy Test, hardening Steel using Different Quenching Media, effects of sintering temperature and pressure on properties (dielectric) of materials synthesized via powder metallurgy. Sample Preparation and Micro-examination of Specimen of materials. Studies on the control of sinter making. Studies of how to test blast furnace burden. How to control sinter via coke additions. Understanding the three stages of blast furnace control. Phases in quenched and tempered steel.	

MME 562: Iron and Steel Making/Heat Treatment Practice - 3 Units	
Course Learning Outcomes (CLOs) **At the end of the course the students should be able to:**	**POs**
understand the raw materials and agglomeration techniques used in iron making, including pelletizing, briquetting, sintering, and ore blending.	1, 2, 4, 7, 9, 11
analyze the two main production routes for iron and steel: blast furnace and direct reduction processes, and perform charge and combustion calculations for these furnaces.	1, 2, 4, 5, 9
examine the different steel making processes, including open hearth furnaces, electric arc furnaces, converters, and their energy utilization.	1, 2, 4, 5, 9, 10
understand the blast furnace/basic oxygen furnace and direct reduction/electric arc furnaces routes in steel making.	1, 2, 4, 5, 9
evaluate secondary steel making processes and their significance in the overall steel production.	1, 2, 4, 5, 9, 10
study the properties and applications of industrially important	1, 2, 4,

ferrous alloys and their selection for specific heat treatments to achieve desired fabrication and service properties.	9
apply the principles of heat treatment to produce steels suitable for various applications and understand the impact of heat treatment on the properties and performance of steel products.	1, 2, 4, 5, 9
Course content Raw materials for iron making, agglomeration – pelletizing, briquetting, sintering and ore blending, coking of coal. Two main iron and steel production routes – blast furnace, direct reduction processes, (midrex, coress, coal reduction, rotary furnace, etc). Charge and combustion calculations of blast and direct reduction furnaces. Ferroalloys. Steel making processes: Open hearth furnace, electric arc furnaces, converters, energy utilization in steel making processes, blast furnace/basic oxygen furnace routes, direct reduction/electric arc furnaces routes. Secondary steel making processes. Industrially important ferrous alloys, selection of proper heat treatments to facilitate fabrication and to yield required service properties in steels suitable for various applications.	

MME 502: Engineering Law – 2 Units	
Course Learning Outcomes (CLOs) **At the end of the course the students should be able to:**	**POs**
understand the history, nature, and division of common law, including its significance in the legal system.	1, 6
explore legislation, including its codification and interpretation, and understand its role in shaping legal principles.	1, 6, 8
examine the concept of equity, its definition, and its main spheres of application within the legal framework.	1, 6, 8
analyze the fundamental principles of contract law specifically related to engineering, including offer, acceptance, communication, and termination	1, 3, 6, 8
gain knowledge of general principles of criminal law, including key concepts and their application in legal proceedings.	1, 6, 8
study the law of torts, including its definition, classification, and liabilities, and understand its relevance to engineering practices and potential legal consequences.	1, 6, 8
explore intellectual property law, including patents, registered designs, and their requirements, applications, types, infringement, as well as the basics of company law, labor law, and industrial law.	1, 6, 8
Course content Common law: Its history, definition, nature and division. Legislation codification interpretation. Equity: definition, and its main spheres. Law of contracts for engineers: offer, acceptance, communication termination.	

General principles of criminal law. Law of torts: definition, classification and liabilities. Patents: requirements, application, and infringement. Registered designs: application, requirements, types and infringement, company law, labour law and industrial law.

MME 564: Extractive Metallurgy II - 2 Units	
Course Learning Outcomes (CLOs) **At the end of the course the students should be able to:**	**POs**
understand the principles and concepts of electrometallurgy, including conductance, transference cell types, and potentials	1, 5, 6
analyze the conduction mechanisms in electrolytes and their significance in extractive metallurgy processes.	1, 5
evaluate current and energy efficiency in electrometallurgical processes and their application in the production of aluminum, electrorefining of nickel and copper, and electroplating.	1, 5, 7, 10
examine interfacial phenomena, such as surface energy, surface tension, and the three-phase interface, and their relevance to extractive metallurgy.	1, 5, 7
explore the electrical double layer, absorption, nucleation, evaporation, and flocculation in relation to metal extraction processes and their practical applications.	1, 5, 7
Course content Introduction to Electrometallurgy: Conductance and transference cell types and potentials, Conduction in electroytes; Current and energy efficiency; Application to extractive metallurgy e.g in Aluminium production, Electro refining of Nickel and Copper, Electroplating: Electrolytic Wining of Cu and Zn. Introduction to interfacial phenomena: Surface energy and surface tension. Interfacial energy of gas/liquid, gas/solid interface. The three phase interface; The electrical double layer, Absorption, nucleation evaporation; Flocculation. Applications to metal extraction processes.	

MME 532: Solid State Materials and Technology - 2 Units	
Course Learning Outcomes (CLOs) **At the end of the course the students should be able to:**	**POs**
acquire a deep understanding of the fundamental concepts of solid state materials, including their structure, bonding, and crystallography.	1, 5, 6
critically analyze the relationship between the structure and properties of solid state materials, considering factors such as defects, impurities, and their impact on mechanical, electrical, and magnetic properties.	1, 5

apply their knowledge of solid state materials to solve real-world problems and explore their applications in various technological fields, such as electronics, energy storage, and advanced materials engineering.	1, 5, 7, 10
develop the ability to design and conduct experiments to characterize and analyze solid state materials, utilizing techniques such as x-ray diffraction, spectroscopy, and thermal analysis.	1, 5, 7
effectively communicate their understanding of solid state materials through oral and written presentations, demonstrating their ability to convey complex scientific concepts, experimental findings, and research outcomes in a clear and concise manner.	1, 5, 7

Course content

Electrical Properties of Metals: - Review of atomic structures of metals; resistivity of metals and alloys; thermal and electrical conductivity in metals; Properties and selection of electrical engineering materials.

Superconductivity: - Survey of superconductivity and mechanism of superconductors; the energy gap; Isotope and mechanical effects; type I and type II superconductors; new superconductors; applications of superconductors.

Magnetic properties of materials:-magnetic permeability; magnetization; para-magnetism, diamagnetism, ferromagnetism, anti-ferromagnetism; hysteresis; ferri-magnetism (ferrites); magnetic materials technology.

Semiconductors:- Band structure of semiconductors; intrinsic and extrinsic semiconductors; semiconductor devices; the p-n junction, rectifiers; diodes, integrated circuits technology.

Dielectrics and Related properties:- Polar dielectrics; the static dielectric constant of solids; ferroelectricity, piezoelectricity; dielectric properties in alternating fields; dielectric constant and dielectric loss; applications of dielectric materials;

Optical properties of solids:- Ionic conduction; optical refractive index and relative dielectric constant; optical absorption in metals; insulators and semiconductors; colour centres; excitons; luminescence; maser and laser; lasers and application of lasers; optical fibres and technology.

MME 554: Mechanical Metallurgy II - 2 Units	
Course Learning Outcomes (CLOs) **At the end of the course the students should be able to:**	**POs**
understand the flow and fracture behavior of engineering materials and the theoretical cohesive strength of solids.	1, 6
analyze stress concentration, crack-tip stresses, and plastic zones in relation to fracture mechanics.	1, 2, 6, 10
apply linear elastic fracture mechanics principles, including the	1, 2,

griffith and orowan theories, to determine fracture toughness and plastic zone sizes.	3, 4, 6
conduct fracture toughness testing and understand its practical application in materials evaluation.	1, 4, 5, 9
evaluate the effects of temperature and metallurgical variables on fracture behavior, including environment-assisted cracking (stress corrosion) of metals.	1, 6, 7
examine the theories of creep, stress rupture, and fatigue, including micromechanisms of creep and the basic equations and parameters associated with creep and fatigue life.	1, 6, 10
Course content Flow and fracture of engineering materials. Theoretical cohesive strength of solids. Stress concentration, crack-tip stresses, and plastic zones. Linear elastic fracture mechanics; Griffith and Orowan Theories, Fracture toughness and plastic zone sizes; Effect of plate thickness. Fracture toughness testing in practice. Notched bar fracture mechanics. Effects of temperature and metallurgical variables on fracture. Environment assisted cracking (Stress corrosion) of metals. Theories of creep, stress rupture, and fatigue. Micromechanisms of creep. Basic equations of creep and the parametric relationships. The Larson–Miller and Sherby–Dorn parameters. Stress relaxation. Stress amplitude–Fatigue Life (S-N) diagrams. Effects of mean stress on fatigue life. The Goodman, Gerber and Soderberg relations. Strengthening mechanisms in metals and alloys.	

MME 599: Project – 3 Units	
Course Learning Outcomes (CLOs) **At the end of the course the students should be able to:**	**POs**
formulate a clear and well-defined research problem or project objective.	2, 6, 11
conduct a comprehensive literature review to gather relevant information and identify gaps in existing knowledge.	2, 6, 10
design and implement a systematic methodology or approach to address the research problem or achieve the project objective.	1, 3, 4, 5, 6, 9, 11
collect and analyze data using appropriate research methods and tools.	4, 5, 9
interpret and evaluate the results of the research or project, drawing meaningful conclusions and making relevant recommendations.	2, 4, 5, 9, 10
communicate the findings, methodology, and outcomes effectively through written reports and oral presentations.	6, 10
Course content	

Supervised final year project which must be approved by the department.

9. ADMISSION REQUIREMENTS

(i) **General:** A candidate seeking admission must have credit level passes in five subjects in either the West African School Certificate (WASC) examination or the General Certificate of Education (GCE) Ordinary Level mathematics, physics, chemistry and any other science subject. In addition, the candidate must have at least a credit pass in English Language in either of the above examinations. The qualifications must be obtained in not more than two sittings.

(ii) **Faculty/Departmental Requirements:** Candidates must have credits in English, mathematics, physics and chemistry. Candidates who satisfy the requirements detailed in (a) above may be admitted into the department after passing an entrance examination (JAMB). Candidates who satisfy the above requirements and in addition have passed mathematics and physics in no more than one sitting or attempt at Principal Level in HSC or at Advanced Level in General Certificate of Education may be admitted into the department by direct entry.

In addition, candidates who satisfy the requirements detailed in (a) and (b) above and have a good National Diploma (OND) or the full Technicians Certificate or their equivalents, may be admitted into the department by direct entry. Candidates admitted by Direct Entry would normally complete the course in four (4) years. Candidates with Higher national Diploma (HND) in Metallurgical and Materials Engineering are eligible to apply for the postgraduate Diploma (PGD). Candidates with Distinction or Upper Credit will be given preference. Also candidates with Third Class in Metallurgical and Materials Engineering are eligible to apply.

10. GRADUATE REQUIREMENTS

To qualify for the award of Bachelor of Engineering Degree (B.Eng) in Metallurgical and Materials Engineering, the candidates must have passed all his courses for the five years durations of the programme, which include the project report.

The level of performance in any examination will be assessed according to the following grading system.

Score	Grade	Grade point
70 and above	A	5
60 - 69	B	4
50 - 59	C	3
45 - 49	D	2
0 - 45	F	0

Cumulative Grade Point Average of CGPA	
4.50 - 5.00 points	First class
3.50 - 4.49 Points	Second Class Honours (Upper division)
2.50 - 3.49 Points	Second Class Honours (Lower division)
1.50 - 2 49 points	Third Class

11. LIBRARY

The department maintains a well equipped departmental library. This is to give our students greater access to modern and specialized books and journals in the Metallurgical and Materials Engineering and other related fields. The Departmental Library augments the University Library for better services to our student. The department's e-library has been very effective in offering our students acess to books that can rarely be accessed as hard copies. The department has more than two hundred and fifty copies of such e-books, journals and hand books in various fields of the course

12. STUDENTS WELFARE

(a). **Handling of Academic Grievances**

All academic grievances emanating from students are first channelled to their academic advisers. When the academic Adviser cannot handle such problem, the adviser channels them to Head of Department. This goes progressively up until it gets to the SENATE.

(b). **Student Academic Advising**

Every level in the Department has one Lecturer as academic Adviser. The academic adviser guides the students throughout his stay in the Department. All academic problems are firstly treated by the adviser before being treated by the Head of Department.

13. EXAMINATION

The examinations are set and conducted by the Lecturers concerned after approval by the Department Board. Quizzes/Tests are done in each course before the examination marks for these are added to the examination marks. The questions for the examinations are submitted to an external examiner before the commencement of the examinations for vetting.

14. ACADEMIC ATMOSPHERE:

The department is dedicated to the maintenance of high academic standard among staff and students, and consequently pursues a deliberate policy of maintaining an academic atmosphere designed to stimulate interest in research and scholarly activities. Staff and students are encouraged to belong to relevant professional society in the country and to participate actively in the Conferences, Seminars and Workshops organized by these societies. The department offers financial assistance and logistic support for staff and students that have papers to present or other key roles to play at these conferences. Regular paper presentation and seminars is a distinguishing feature of the department. Currently, the department organizes two types of seminars.

(a). **Departmental Seminars:**

This features monthly presentation of papers by staff and students. Final year undergraduate students and postgraduate students are regularly programmed to present papers on their on-going projects, while academic and technological staff at the same time present papers on their research work.

(b). **Interdisciplinary Colloquium Series:**

Which feature quarterly paper presentation by top scholars in the field and in related scientific/technological fields. The scholars who present these papers are invited from within and outside the University.

15. ACADEMIC CONTENT

(a). Programme Title:

Undergraduate Degree Programme in Metallurgical and Materials Engineering (B .Eng).

(b). Departmental Degree Programme

The Department offers a five-year programme leading to the degree of Bachelor of Engineering (B.Eng.) in MME. During the first one and half years of the programme, the student takes courses in mathematics, physics, chemistry computer programming & languages, and other foundation courses, which are common to some departments in the University. Thereafter, the student then concentrates on the core departmental courses in Metallurgical and Materials Engineering.

The long vacation of the fourth year and second semester of the fourth year are devoted to industrial attachment during which the student works and learns in an industrial environment.

In the fifth year, the student concentrates on an area of specialization, and also undertakes a development or design project leading to a mandatory thesis before graduation.

(c). Areas of Specialization

There are presently available four (4) areas of specialization within the Department, namely:

(1) Mechanical Metallurgy

(2) Extractive/Chemical Metallurgy

(3) Physical Metallurgy

(4) Materials Science

16. CREDIT HOURS AND COURSE NUMBERING

(a) **Credit** Hours

The departmental programme is based on the course credit hours. A credit (unit) is one hour lecture contact per week, or two or three hour laboratory/practical/workshop/tutorial class per week or an equivalent amount of study or any combination of these lasting a semester. Thus a credit (unit) load is equivalent to 15 lecture hours or 30-45 hours of practical studio work or tutorials

(b) Course Numbering

The courses given by each department are numbered 100 to 599. The number of each course is preceded by a three character course code common to all the department's courses. For example, MME253: MME denoted the Department of Metallurgical and Materials Engineering; the first digit denotes the level or year of study in which the course is taught i.e. the first year; the second digit denotes subject area (specialist or stress area); the third digit denotes the order in which the courses are given provided that the odd numbers represent first semester courses and even numbers represent second semester courses, zeros (0) represent course running throughout both first and second semesters and second and third digits as 99 represent courses during the long vacation etc. (viz SIWES/IT).

17. ATTENDANCE AT LECTURES

(a) **Attendance** at lectures, tutorials, laboratory workshop practical, studio sessions, is compulsory. Class Admit Cards should be used to effect this regulation.

(b) Repeat courses should be attended in their entirety. Most of the problems encountered by students under course credit system are caused by student's failure to attend lectures and do in-course assessment in courses which they are repeating. Repeating courses without attending the whole course of lectures and doing all the class assignment has often resulted in repeated failures. Even when the same lecturer is giving a course a second or a third time, he/she will more often than not modify his/her teaching to incorporate recent advances or give a different emphasis to one part of the syllabus or another. This will make things difficult for the student who is relying only on reading of previous notes.

18. COURSE EVALUATION/SEMESTER EXAMINATION

Students may be evaluated by a combination of the following methods:

i. Unannounced quizzes

ii. Take home assignment

iii. Assessment of workshop/laboratory/studio.

iv. Mid semester examination

v. Semester (end of course) examination

i to iii above make up the continuous assessment which forms part of the end of course grading, provided that it does not count for more than 30%. There shall be no less than two continuous assessments per semester.

19. CREDIT LOAD

A student shall normally, in any one academic year be allowed to register for, and take a minimum of, 30- and a maximum of 48-credits. This means that a student can register for a minimum of 15 credits and maximum of 24 credits per semester. Thus no student can be credited with more than 48 credits at the end of each academic year. Without prejudice to the above, a graduating student may register for only the number of credits he/she requires to graduate.

20. REGISTRATION OF COURSES

(i) All courses to be taken in the first and second semesters are registered at the beginning of every session. Failed courses are

registered first and higher level courses are then added to make up the approved minimum of 24 credits per semester. If the student is advised to carry full load.

(ii) Failure to register means that no record of the student will be in the department and Faculty for that session and consequently no provision will be made for the student's examinations.

(iii) Registration forms must be carefully and correctly filled out. Cancellations, erasures, mutilations, etc are not allowed on the forms. Any form bearing any of these defects is nullified and therefore unacceptable. Academic advisers should be consulted before filing the registration forms.

(iv) Late registration may be allowed only on payment of a penalty fee which varies from time to time according to university regulations.

(v) There is no promotion from year to year within the course credit system. If the time table permits, a third year student may, for example, take a lower level course, provided that s/he has the prerequisites (if any).

(vi) Students are never asked to repeat an entire year unless their Cumulative Grade Point Average is below 1.0. They repeat only those courses which they fail. Students carrying over courses shall not be allowed to register for more than the approved number of credits for the session.

(vii) Postponement of carry-over is not allowed. This implies that a student in second year cannot carry over year one Course to the third year. The carry-over 100 level Course must be taken in year two

Credit Hrs	%age Score	Letter grade	Grade Point (GP)	Final Cum GP Average (FCGPA)	Class of Degree
A	B	C	D	E = D/A	F
	70-100	A	5.00	4.50-5.00	First Class

60-69	B	4.00	3.50-4.49	2nd class
50-59	C	3.00	2.40-3.49	2nd Class
45-49	D	2.00	1.50-2.39	3rd Class
40-44		1.00	1.00-1.49	Pass
0-39	F	0.00	0.00-0.00	Fail

The degree classification will be based on the Final Cumulative Grade Point Average (FCGPA). FCGPA is calculated by dividing the sum of all Grade Points for all the courses taken (including failed courses) by the total credits of courses taken

21. GRADING OF REPEATED COURSES:

Students earn their full marks in repeated courses. However, in calculating the FCGPA, the Grade Points earned in all attempts (including failed attempts) are used

22. WITHDRAWAL FROM THE UNIVERSITY:

Any of the under listed factors may necessitate the withdrawal of a student from the university:

(a) Withdrawal on Academic Grounds

A student whose CGPA drops below 0.80 at the end of a particular period of academic probation should withdraw from the university. However consideration may be given for withdrawal from programme of study and possible transfer to other programmes within the university for which the student is qualified and may have aptitude. If *s/he* stays on probation for another year in the new programme, *s/he* will be required to withdraw finally from the university. For students who repeat the year of study following their poor performance in the proceeding academic year (see 10.37)(C) Below), they are expected to achieve a CGP A of not less than 1.50 before they would be allowed to continue in their programme. If they fail to achieve the minimum CGPA, they will be required to withdraw from the university.

A student who spends more than 50% above the stipulated number of years of the programme in which s/he is enrolled should apply through his/her HOD and Dean to Senate for extension of his/her registration. Registration can be extended for another 50% of the stipulated number of years of the programme.

To grant extension, the student would have paid the Registration/ Extension fee approved by Senate which usually is not less than half the total fee paid by the fresh students. Students granted extension will in addition pay all approved school fees during the period of extension. If after this extension, the candidate is unable to complete the programme, the student should withdraw from the university.

(b) Voluntary Withdrawal

Students may withdraw voluntarily from the university at any time on the completion of the official withdrawal forms obtainable from the Records officer of the university.

Such students may retain the grades made for the courses already completed and passed. Students who have thus withdrawn voluntarily from the university may apply to the Registrar for re-admission.

(c) Withdrawal on Health Reasons

An approved medical officer may recommend that a student withdraws or be asked to withdraw from the university on health grounds. The affected student may be re-admitted into the university on production of a valid medical certificate of fitness from an approved medical officer.

(d) Withdrawal for Disciplinary Reasons

Students who are asked to withdraw for disciplinary reasons may appeal against the direction in accordance with the provisions of the University Edict on discipline of students.

(e) Unauthorized Withdrawal

Students who withdraw from the university without authority shall be deemed to have processed themselves out of the university.

23. ACADEMIC PROBATION

A student admitted through the University Matriculation and Examination goes on probation if, after the second semester examination his or her CGPA is 1.20.

A probationary period is a period of trial (not a repeat), during which s/he is expected to improve on her/his academic performance.

24. REPETITION OF YEAR OF STUDY

(a) A student whose CGPA drops below 1.00 but above 0.60 is expected to repeat the year in the following academic year during which s/he is expected to achieve a CGPA of not less than 1.50. If s/he fails to achieve that minimum s/he shall be required to withdraw from the university.

(b) A student repeating the year of study following a CUPA of less than one carries only 75% of the total credit load for that year in which s/he is repeating.

(c) A student cannot graduate and must withdraw from the university if, on account of repeating the year, s/he spends more than 50% above the stipulated number of years of the programme in which s/he is enrolled.

25. GENERAL INFORMATION ON FINAL YEAR EXAMINATION

(a) In the final year the students take the normal first semester examinations and the second semester examinations are based on the second semester courses and any other relevant areas as required by the department.

(b) Each semester examination should not normally last for more than three hours.

(c) Departmental Board of Examiners shall normally meet with the external examiners to agree on grades/results before formal presentation of these results to the Faculty Board and hence to the College Academic Board and Senate.

(d) Any final year student who fails one or two final year first and second semester courses shall be required to register for the courses failed in the following academic year. S/he shall not be required to

carry the minimum 15 credits but s/he shall, however pay the full fees of the semester in which the courses s/he is re-registering are offered and appropriate examination fee for the semester courses.

(e) The result shall be presented to Senate for approval through the Faculty Board and Registrar.

(f) University regulations on re-registration of courses and withdrawal from the university shall, subject to the provisions of 11 and 12 above, apply in all cases.

26. FINAL YEAR EXAMINATION

(a) The Registrar shall circulate an Examination Time Table to departments not later than two weeks before the start of examinations.

(b) Lectures and other class work shall normally end at least one week before the start of examination to enable adequate revision to be made.

27. RESULTS

(a) A student is considered to have passed the examination if he obtains a grade of "E" in each of the courses published for his department.

(b) In the case of final year students, successful candidates shall be issued with degrees bearing the following performance levels on the FCGPA.

FCGPA	PERFORMANCE LEVEL
4.50 - 5.00	First Class Honours
3.50 - 4.49	Second Class Honours Upper Division
2.40 - 3.49	Second Class Lower Division
1.50 - 2.39	Third Class
1.00 - 1.49	Pass
Below 1.00	Fail

28. FUNCTIONS OF THE VARIOUS ARMS OF THE DEPARTMENT IN THE CONDUCT OF EXAMINATION

(a) The Departmental Examinations Committee

It shall be the function of the Departmental Examinations Committee to:

i. Consider, moderate and approve question papers submitted to the Head of Department by internal examiners (course lecturers) from 100 level to 300/400 level examinations, and in the case of 400 or 500 level examinations, to consider, moderate and approve draft question papers to be moderated by the external examiner.

ii. Recommend to the Head of Department the appointment of External Examiners.

iii. Consider review (if necessary), and prepare examination results by all internal examiners to the Department and prepare pass/failure and referral lists and forward them to the Faculty Board of Examiners.

iv. Make recommendations to the Faculty Board of Examiners about any special cases.

v. Make recommendations on the award of Aegrotat degree to the Faculty Board of Examiners.

vi. Carry out any other activities related to the conduct and administration of examinations as may be prescribed by the Faculty Board of Examiners.

(b) The Head of Department

It shall be the function of the Head of Department to:

i. Serve as the Chairman of the Departmental Examinations Committee.

ii. Appoint the Departmental Examinations Officer from among members of his/her academic staff, normally not less than the rank of a Senior Lecturer.

iii. Keep custody of all examination question papers and moderated questions and ensure that they are not made known to any unauthorized persons.

iv. Make requisition for, and take charge of all examination materials obtained from the Dean of the Faculty and/or the Registrar.

v. Recommend to the Dean the appointment of invigilators for all examinations in the Department.

vi. Ensure the compliance of all internal examiners with the rules regarding the setting and moderating of question papers and the marking of examination scripts and the computation of the results therefore.

vii. Ensure compliance with all rules regarding eligibility of students during such examinations.

viii. Nominate to the Dean, persons to be appointed external examiners on the recommendation of the Departmental Examinations Committee.

ix. Carry out general supervisory roles on all activities relevant to the design, moderation, conduct and security of all examinations in his/her Department.

x. Receive complaints from students on examination conduct and result and process them through the Departmental Examinations Committee to the Faculty Board of Examiners.

xi. Liaise with the Registrar in keeping appropriate contact with the Departmental External Examiners and ensure timely moderation of 400/500-levelcxamination questions by the external examiner.

xii. Liaise closely with the Faculty Officer in arranging for the reception, transportation, accommodation of Departmental External Examiners and ensuring the appropriate remuneration due to the External Examiner is paid.

xiii. Ensure that all departmental examinations are adequately catered for in the official university Time Table and allocate halls, rooms, laboratories, and workshop space or each examination in the department.

(c) The Departmental Examination Officer

It shall be the function of the Departmental Examinations Officer to

i. Serve as a liaison officer between the Internal Examiners (course lecturers and course co-ordinators) and the Departmental Board.

ii. Prepare the Departmental/Faculty Time Table for each examination.

iii. Collect at the end of each examination, the examination answer scripts from the chief invigilator and assign them to internal examiners for marking of scripts and collate all scores for each examination from Internal and External examiners and process, compute and compile them for presentation to the Departmental/Faculty Board of Examiners through the Head of Department.

iv. Perform any other activities in relation to the setting, conduct and processing of examination results in the Departmental/Faculty as may be prescribed by the Head of Department/Dean and Departmental/Faculty Examination Board.

29. STUDENT RECORDS AND ISSUANCE OF SEMESTER/FINAL EXAMINATION RESULTS

(a) Students' records shall be held in the Registrar's Department in the manner approved by Senate.

(b) The Examinations and Records units shall issue semester examination results to relevant students, with copies to the Dean of Faculty, Heads of Department and the sponsors.

(c) Lists of possible graduands shall be published by the Registrar after reconciling records with the faculties.

(d) Statements of all final year results and official transcripts shall be issued by the Registrar.

30. PROCEDURE FOR HANDLING STUDENTS' PETITIONS

When a student has a grievance involving his course, examinations or results, he may seek redress by submitting a written petition in accordance with the following procedure

31. GRADES FOR LECTURES, TUTORIALS, PRACTICAL ASSIGNMENTS, TESTS

Students' petition under this category should be directed to the Head of Department where the course is taught. The Head of Department after due consideration, will dispose of the matter and communicate to the student. If the student is not satisfied with the decision of the Head of Department he may appeal through the Head of Department to the Dean of the Faculty and if need be, through him to the College Academic Board and if further need arises, to Senate through the Academic Board.

32. REVIEW OF EXAMINATION PAPERS

Where a student's petition on examination results requires the review of already marked script, an approved fee must be paid per script by the student before the petition would be entertained. Such petition should be directed to the Secretary to Senate with receipts of payment of requisite fees attached, for necessary action.

In the remarking process, only one independent person should be accepted to remark a paper and the marks awarded by this independent person should be accepted as final. Where the remarking process involves final year second semester courses which had previously been moderated by an External Examiner, the remarking should be done by the External Examiner whose grades shall be accepted as final. If however, the paper in question was one of the papers picked up and remarked by the External Examiner during his/her random sampling of answer scripts, the marks earlier awarded by the External Examiner shall stand.

33. CATEGORISATION OF EXAMINATION IRREGULARITIES AND ACCOMPANYING PUNISHMENT AS APPROVED BY SENATE

(a) Examination Offences Committed by Students

The various examination offences committed by students are categorized as follows:

i. Offences punishable by expulsion from the university.

ii. Offences punishable by suspension for one year or more

iii. Offences punishable by failure in the course

iv. Offences punishable by issuing a student with written warning

The following sanctions are recommended as appropriate for the various examination offences which are very common among students.

Punishment for Examination Offences Committed by Students

Group A:

Offences punishable by Expulsion from the University

i. Assault on an invigilator

ii. Impersonation: When the impersonator is not a student of ESUT, s/he should be handed over to the Police and if s/he is from another tertiary institution and his particulars are known, he should be reported to his institution.

iii. Involvement in alteration of grades.

iv. Being in possession of any dangerous weapon in and around examination venue. (In addition, the student should be handed over to the Police).

GroupB:

Offences punishable by Three (3) Years Suspension

i. Involvement in examination leakage

ii. Destruction of evidence relevant to the case

iii. Smuggling already prepared answer scripts into the examination hall.

Group C:

Offences Punishable by Three (3) Years Suspension for the Second Offender and Two (2) Years for the First Offender

i. Being in possession of material relevant to the examination

ii. Refusal to surrender exhibit in connection with the examination offence

iii. Snatching of answer script from another student

iv. Writing solutions on any part of the body or clothes

v. Use of calculators to store informations relevant to the solutions.

Group D:

Offences Punishable by Three (3) Years Suspension for the Second Offender and One (1) Year for the First Offender

i. Smuggling out answer script from exam hall

ii. Smuggling out examination questions from exam hall

iii. Exchange of answer scripts during an examination for the partners

iv. Failure/refusal to submit answer script after examination

Group E:

Offences Punishable by One (1) Year Suspension for the Second Offender and Being Made to Fail Examination for the First Offender

i. Writing solutions on any part of the question paper

ii. Exchanging of question papers with solutions written on any part of them

iii. Cheating by peeping into another person's work during an examination

iv. Displaying one's work for another to copy from

v. Talking to, or with another student during examination

vi. Disobeying the invigilator during an examination; e.g. refusal to relocate; refusal to stop writing; refusal to sign in and out; undue delay in submitting answer script at the end of the examination.

vii. Creating disturbance during the examination, e.g. shouting slogan, shuffling feed unduly, whistling, fighting (both partners), assaulting another student, causing panic, etc.

viii. Unjustified verbal attack on the invigilator.

34. INDUSTRIAL TRAINING

Objectives

The objectives of the Enugu State University of Science & Technology on Industrial Training and practice are:

a. A total commitment to the kind of creative problem approach that can be likened to the Theoretical Construct learned in the classroom into technically designable and economically manufacturable ideas.

b. A commitment to education in Industrial Technology ramifications. The scope of the objectives of this industrial

training and practice for the students must include among other things:

c. Understanding of the business aspects of the operation of an industrial organization with its marketing and economic resources and the nature and importance of the engineering knowledge within it.

d. Understanding of systems of communication and control within organization.

e. Personal skills of working with other people at all levels in an understanding or the organization.

f. Understanding of the organizational and administrative principles of running a business, particularly the roles of financial control, costing and marketing.

g. Appreciation for the kinds of work in which an Engineer can best contribute to the business and most effectively develop his or her own potential.

h. Experience in carrying out engineering tasks to build confidence in the application of knowledge to the solution of real problems.

i. Understanding and appreciation of the requirements of continued research and development to improve product as the basis for continued economic existence via well easily marketable products. The University firmly believes that an Industrial Training and Practice Programme structure such as this, when fully implemented and rigidly followed, would lead to highly skilled and motivated individuals who can be considered to be fit to begin practice as scientists, technologists or engineers upon graduation.

Duration

The Industrial training and practice is structured to last for six (6) months and is phased as follows:

i. First two months: Learning the basic skills in the use of industrial tools and equipment.

ii. Second two months: Copy designs or re-invention of existing ideas, using the skills learnt during Phase 1.

iii. Last two months: Execution of well-defined projects, usually chosen by students either on individual or collective basis, to realize a specific product.