DEPARTMENT HANDBOOK

Bachelor of Engineering [B.Eng.]

in

MATERIALS AND METALLURGICAL ENGINEERING

[2022 – 2027]

AFRICAN UNIVERSITY OF SCIENCE AND TECHNOLOGY

CONTENTS

1.0 INTRODUCTION TO AFRICAN UNIVERSITY OF SCIENCE AND TECHNOLOGY (AUST)

Although situated in Nigeria, The African University of Science and Technology, Abuja (AUST-Abuja) was set up to be a pan-African university to serve all of sub-Saharan Africa. It is the first of a small group of institutions created to be part of a framework called the African Institute of Science and Technology (AIST), others are now to be found in Burkina Faso and Arusha, Tanzania. The AIST concept drew its inspiration from the highly successful Indian Institutes of Technology (IIT) and the Indian Institute of Science (IIS). AUST is a respected, not-for-profit world-class technological university, whose purpose is to train, and help retain in Africa, top-level scientists and engineers. The medium of instruction at AUST-Abuja is English. Special language courses are provided for non-English speakers to prepare them for participation in programs in English. The AUST-Abuja campus is located within the Abuja Technology Village (ATV), a planned cluster of leading research institutions and technology companies, located on a 1,000-hectare site where it occupies 240 hectares. The land was donated by the Government of Nigeria for this purpose. It is conveniently situated just 10 minutes from Abuja's city centre and 20 minutes from Nnamdi Azikiwe International Airport. AUST received accreditation from the Nigerian Universities Commission (NUC) in 2007 and received its first batch of students in 2008. Since then, true to the philosophy behind its establishment, as a pan-African institution to build science, engineering and technology capacity in all of sub-Saharan Africa, AUST has educated students from more than 26 African countries in East, West, Central and Southern Africa

In its short 16 years of teaching, research and innovation, AUST has already matured into a promising institution with a combination of Resident Faculty, over 40 full-time staff members, 80 visiting Faculty, world renowned specialists in their fields, brought in every year to teach and supervise research for over 160 MSc/PhD students in Computer Science, Materials Science and Engineering, Petroleum Engineering, Pure and Applied mathematics and Theoretical and Applied Physics. It is not surprising that AUST is already emerging as a noteworthy research university in the heart of Africa; the University has already become one of the very few African universities designated as a Center of Excellence by the World Bank, with a special focus on its programs in Material Science and Engineering and thus serves as the coordinating center for the region's Pan African Materials Institute (PAMI). Our groups in materials science and physics are developing the next generation of organic solar cells and light emitting devices. They are also developing the next generation of nanoparticles now being used in the detection and treatment of such medical conditions as cancer and cardiovascular disease. Similarly, our groups in petroleum engineering are working on using cutting-edge theoretical and computational tools to develop new tools for the oil and gas industry. These include theoretical and computational tools for flow assurance and reservoir management, as well as the introduction of nano-mechanics and fracture mechanics to the management of pipelines, reservoirs and offshore structures.

In the area of computer science, our DEVS team has won a number of top awards at International Conferences and professional events. The groups in computer science are also working on e-learning platforms and wireless technologies that are being integrated with mobile telecommunications. This is being done in an environment that has a 64-node multi-processor that has been used as the basis for the setting up of a high-performance computing (HPC) array. Our mathematics group has established

itself as one of the leading groups in functional analysis. With its recent focus on fixed point theory and equations of the Hammerstein type, they are solving problems at the frontiers of mathematics.

The fundamental objective of the African University of Science and Technology (AUST) is to educate the next generation of African scientists and engineers – providing them with the technical and leadership capacities to solve real African problems and contribute to the economic and social transformation of the continent. AUST will deliver a strong foundation in the fundamentals of mathematics and science; a deep understanding of the research frontiers; and an orientation towards entrepreneurship and service. AUST is committed to excellence in teaching, research and service. It is also motivated to build collaborative partnerships with for-profit and not-for-profit institutions to support the millennium goals for the development of the African Continent. The goal of the curriculum is to prepare students to become very high-level professionals who can play a transformational role in African industry/business and academia.

2.0 INTRODUCTION TO THE MATERIALS AND METALLURGICAL ENGINEERING PROGRAMME

The Materials and Metallurgical Engineering (MME) programme at AUST started in 2008, with only MSc degree being awarded. Over 200 MSc degrees have been awarded in this programme till date. The PhD programme started in 2012 and till date, over 50 PhD degrees have been awarded in the programme.

Materials and Metallurgical Engineering combines engineering, physics and chemistry principles to solve real-world problems in the fields of nanotechnology, biotechnology, information technology, energy, manufacturing and other major engineering disciplines.

Materials scientists make the materials that make everything better. Everything is made of something. Materials scientists investigate how materials perform and why they sometimes fail. By understanding the structure of matter from the atomic scale to the millimeter scale, they invent new pathways to combine chemical elements into materials with unprecedented functional properties. Other branches of engineering rely heavily on materials scientists and engineers, from the advanced materials used to design and manufacture products such as safer cars with better gas mileage, faster computers with larger hard drive capacities, smaller electronics, threat-detecting sensors, renewable energy harvesting devices and better medical devices. MME is the field that leads in the discovery and development of the stuff that makes everything work. Materials scientists even work in museums, helping to analyze, preserve and restore artifacts and artwork. Materials scientists work with diverse types of materials (e.g., metals, polymers, ceramics, liquid crystals, composites) for a broad range of applications (e.g., energy, construction, electronics, biotechnology, nanotechnology) employing modern processing and discovery principles (e.g., casting, additive manufacturing, coating, evaporation, plasma and radiation processing, artificial intelligence and computer simulations).

2.1 Mission

The Materials and Metallurgical Engineering Department's mission for undergraduate education is to create a specialized institution committed to the pursuit of academic innovation, a tradition of excellence and production of excellent scientists and engineers who are prepared for broader roles as leaders and agents of positive change in Africa's societies.

2.2 Vision

To be a world-class department dedicated to academic freedom and pursuit of excellence. This represents a global vision to foster sub-Saharan Africa's economic growth and development through the promotion of excellence in science and technology and their application.

2.3 Philosophy

The Philosophy and Mission Statement underlying the programme in Materials and Metallurgical Engineering are based on the general philosophy of engineering education aimed at achieving the goals and objectives of the African continental policy on industrialization and self-reliance. This is to be achieved through:

- Broad–based foundation in engineering and technology as well as specialized knowledge and practice in Materials and Metallurgical Engineering. Practical exposure to application of Engineering and Technology to problem solution.

- Adequate training in human and organisational behaviour and management.
- Developing in the product's entrepreneurial knowledge, a sense of public responsibility and a spirit of self-reliance.
- Nurturing of partnership between the institution and industry for effective programme delivery.
- Creating an 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.
- 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 in Materials and Metallurgical Engineering.

The general philosophy therefore is to produce graduates 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.

2.4 Aim and Objectives

The general goal and objectives of engineering and technology education and training are in consonance with the realization of national needs and aspirations vis-à-vis industrial development and technological emancipation. The graduates must therefore be resourceful, creative, knowledgeable and able to perform the following functions:

- To design engineering projects and supervise their implementation.
- To design and implement components, machines, equipment and engineering systems.
- To design and develop new products and production techniques in industries.
- To install and maintain complex engineering systems for optimal performance in our environment.
- To adapt and adopt exogenous technology in order to solve local engineering problems.
- To be able to exercise original thought, have good professional judgment and be able to take responsibility for the execution of important tasks.
- To be able to manage people, fund, materials and equipment.
- To improve on indigenous technology for deployment to the solution of local problems in Materials and Metallurgical Engineering.

2.5 Areas of Specialization

The primary areas of specialization are as follows:

- Materials Science
- Polymeric Materials
- Ceramic Materials
- Composite Materials
- Electronic Materials

- Metallurgical Engineering
- Biomaterials
- Biomass Engineering

2.6 Admission Requirements

2.6.1 Entry Requirement and Duration

The entry requirements are at least credit level passes in five subjects to include English Language, Mathematics/Further Mathematics, Physics, Chemistry, and any other science subjects, at the Senior Secondary School Certificate or its equivalent.

2.6.1.1 Nigerian Students

The entry requirements shall be at least credit level passes in five subjects to include English Language, Mathematics/Further Mathematics, Physics, Chemistry, and any other science subjects, at the Senior Secondary School Certificate or its equivalent. In addition, an acceptable pass in the Unified Tertiary Matriculation Examination (UTME) is required for admission into 100-level. Candidates are admitted into the degree programme in any of the following three ways:

- The University Tertiary Matriculation Examination (UTME)
- Direct Entry
- Inter-University Transfer

2.6.1.2 UTME Entry Mode

The minimum academic requirement is credit level passes in five subjects at O'Level in national Examination/Cambridge O'Level: Mathematics/ Further Mathematics, English Language and three (3) other Science subjects.

UTME SUBJECTS: Physics, Mathematics and Chemistry

2.6.1.3 Direct Entry Mode

- In addition to O'Level requirements stipulated above, applicants should possess at least two A'Level papers in Level in relevant subjects (Chemistry, Mathematics and Physics, Biology) may be considered for admission into 200-level.
- OND in relevant discipline with at least upper credit grade in addition to the five credit passes as stated above.
- HND in relevant discipline with at least upper credit in addition to five credit passes as stated above.
- Joint Universities Preliminary Examinations Board (JUPEB)/ Interim Joint Matriculation Board Examination (IJMBE) and AUST Foundation Program are also acceptable.

2.6.1.4 Foreign Students

The University proposes to admit foreign students through the options listed below and will comply with the admission policy into Nigerian Universities and JAMB:

- Scholastic Aptitude Test (SAT) – An international entrance exam for admission into Universities in the United States and American University abroad, which is conducted in over 130 countries.

- Any other internationally recognized University Entrance Exam, equivalent of the JAMB in Nigeria.
- Joint Universities Preliminary Examinations Board (JUPEB)/ Interim Joint Matriculation Board Examination (IJMBE) and AUST Foundation Program are also acceptable.

2.6.2 Duration

A student will not be allowed to exceed an additional 50 per cent of the duration of the programme if he fails to graduate within the minimum number of years.

2.6.2.1 UTME

Five (5) academic sessions or ten (10) semesters.

2.6.2.2 Direct Entry

Four (4) academic sessions or eight (8) semesters. In general, no student will be allowed to exceed an additional 50% of the normal duration of the programme.

2.7 Graduation Requirements

To qualify for the 5-year Bachelor of Engineering (B.Eng.) degree award in the Materials and Metallurgical Engineering programme, a student must pass the minimum number of credit units as shown in the Tables 1-3. This table is based on Minimum Academic Standards and guidelines of National Universities Commission (NUC).

2.7.1 Course Credit System

Students in department of computer science are expected to take a minimum of 150 credit units for the award of a Bachelor's degree in Materials and Metallurgical Engineering. A minimum of 15 credit units and a maximum of twenty-four (24) credit units should be taken by each student per semester. Each of the courses in the programme is expected to be taught for a semester which will last for a minimum of fifteen (15) weeks. The teaching should be distributed into lectures, tutorials and workshops/studio practical.

2.7.2 Grading of Courses

The grading system provided by the University is an indicative policy for the calculation of grade point average (GPA). The grading system policy for students at AUST showing the letter grades, its corresponding grade point and the score range is shown overleaf:

Table 1: Grading System at AUST

Grades on 4.0 Scale	Letter Grade	Score Out of 100
4.00	A	95 – 100
3.75	A-	89 – 94
3.25	B+	83 – 88
3.00	B	77 – 82
2.75	B-	71 – 76
2.25	C+	65 – 70
2.00	C	59 – 64
1.75	C-	53 – 58
1.00	D	48 – 52
0	F	0 – 47

2.7.3 Grade Point Average and Cumulative Grade Point Average

For the purpose of determining a student's standing at the end of every semester, the Grade Point Average (GPA) system shall be used. The GPA is computed by dividing the total number of Units x Grade Point (TUGP) by the total number of units (TNU) for all the courses taken in the semester. The Cumulative Grade Point Average (CGPA) over a period of semesters is calculated in the same manner as the GPA by using the grade points of all the courses taken during the period. Calculation of GPA or CGPA is shown in Table 2.

Table 2: GPA Calculation

Course	Units	Grade Point	Units x Grade Point (UGP)
C_1	U_1	GP_1	$U_1 \times GP_1$
C_2	U_2	GP_2	$U_2 \times GP_2$
-	-	-	-
-	-	-	-
C_i	U_i	GP_i	$U_i \times GP_i$
-	-	-	-
-	-	-	-
C_N	U_N	GP_N	$U_N \times GP_N$
TOTAL	TNU		TUGP

$$TNU = \sum_{i=1}^{N} U_i \qquad TUGP = \sum_{i=1}^{N} U_i * GP_i \qquad CGPA = \frac{TUGP}{TNU}$$

2.7.4 Degree Classifications

Classes of degree are to be awarded depending on the cumulative GPA obtained. The classes of degrees that may be awarded are First Class Honours, Second Class Honours (Upper Division), Second Class Honours (Lower Division) and Third Class Honours. Table 3 shows the degree classification.

Table 3: Degree Classification

CGPA	CLASS OF DEGREE
3.50 – 4.00	First Class Honours
2.50 – 3.49	Second Class Honours (Upper Division)
1.40 – 2.49	Second Class Honours (Lower Division)
0.50 – 1.39	Third Class Honours

2.7.5 Probation

Probation is a status granted to a student whose academic performance fall below an acceptable standard. A student whose Cumulative Grade Point Average is below 0.50 at the end of a particular year of study, earns a period of probation for one academic session.

2.7.6 Withdrawal

- A student shall be requested to withdraw from a programme if at the end of a probation period, the student still does not make satisfactory progress. Such student shall be at liberty to apply for a change of programme within the University.
- Subject to the conditions for withdrawal and probation, a student may be allowed to repeat the failed course Unit(s) at the next available opportunity, provided that the total number of credit units carried during that semester does not exceed 24, and the Grade Points earned at all attempts shall count towards the CGPA.

2.8 Evaluation

2.8.1 Techniques of Students Assessment

The evidence, on which the assessment of a student's achievement is based, will include the following:

- Formal examinations
- Laboratory Reports
- Problem Solving Exercises
- Oral Presentations
- Essay Assignments/Term Papers
- Collaborative Project Work
- Individual Project Work
- Report on External Placement (SIWES)
- External Examiners Report
- Surveys and Evaluations

2.8.2 External Examiner's System

External examiners shall be appointed once in a year particularly at the end of each session to moderate examination questions, review the scripts of the students, and provide an overview of the work of the students in all classes, particularly those in the final year. It shall be mandatory on the Chief Examiner to review the questions set by his colleagues before those questions are forwarded to the External Examiner in order to ensure that they reflect the coverage of the syllabi and the manner in which they were taught. The system also provides avenues for assessing comparability of programmes and the maintenance of minimum standards.

2.8.3 SIWES Rating and Assessment

The Nigerian Universities Commission (NUC) has mandated and approved Students Work Experience Programme (SWEP) and Students Industrial Work Experience Scheme (SIWES), for Nigerian Universities and other institutions of higher learning; for its students to undergo various training in their respective fields of studies due to lack of relevant facilities and machinery within the Nigerian Universities. Thus, mandatory for all students offering relevant courses in higher institutions to undergo the SWEP and SIWES programme at their assigned level and stipulated time. The exposure to a combination of field and office experience both in the public and private sectors and/or construction activities relevant to their individual disciplines. All students in the Materials and Metallurgical Engineering discipline will be exposed to a period of compulsory, supervised SIWES in addition to Laboratories, Workshop, Practical, Studio Training as reflected in the individual programmes. Such training shall be undertaken in an approved establishment. A minimum period of a semester is considered to be adequate. The student is expected to submit a systematic log-book for assessment at the end of the training period. Students with unsatisfactory performance shall be required to repeat the training programme.

2.8.4 Students' Evaluation of Courses

At the end of every semester, students shall be given the opportunity to evaluate the courses taken in the semester based on the following criteria:

- relevance
- adequacy in terms of time and content coverage
- students understanding of the courses
- adequacy of lectures, tutorials and practical
- standards of continuous assessment and examinations

2.8.5 Maintenance of Curricula Relevance

The various curricula for the Materials and Metallurgical Engineering should be reviewed from time to time as reflected in each individual programme. General review will be conducted every five (5) years, in full consultation with the relevant professional bodies.

2.8.6 Performance Evaluation Criteria

The general performance indices useful to accreditation assessors and for internal review terms are as specified in each individual programme, especially as these relate to the following: staff/student ratio, facilities such as laboratories, workshops, library/Information and Communication Technology (ICT), staff composition and minimum space requirements.

3.0 RESOURCES

3.1 Staffing

	ACADEMIC STAFF				SNR. TECH. STAFF	SNR. ADMIN. STAFF		JUNIOR STAFF	
	PROF.	READER/ ASSOC. PROF.	SNR. LECT.	LECT. 1 & BELOW		SEC.	NON-SEC.	TECH.	NON-TECH.
Core Staff on the ground for the programme	1	1	7	4	2	1	1	1	1
Staff available for the programme from other source (s)	5	1	2						
Total	6	2	9	4	2	1	1	1	1

Table 4: List of Existing Academic Staff for The Programme

S/N	Name	Qualif. & Rank	Areas of Specialization	Discipline	Status
1.	Anye Vitalis	PhD Assistant Professor	Energy	Materials Science and Engineering	HOD (FT)
2.	Peter Azikiwe ONWUALU	Ph.D. Professor	Biomass Engineering, Agro-Materials, Power and Machinery, Energy, Building Materials.	Agricultural Engineering	FT
3.	Wole SOBOYEJO	Ph.D. Professor	Biomaterials, Aerospace Engineering	Mechanical and Aerospace Engineering	PT
4.	Douglas J. BUTTREY	Ph.D. Professor	Chemical and Biomolecular Engineering	Chemical Engineering	PT
5.	Esidor NTSOENZOK	Ph.D. Professor	Materials for energy	Physics	PT
6.	Emmanuel BOAKYE	PhD Professor	Ceramic Materials-Multifunctional	Mechanical Engineering	PT
7.	Adelan Rasak ADETUNJI	PhD Associate Professor	Mineral Processing	Materials and Metallurgical Engineering	PT
8.	Shola ODUSANYA	PhD Associate Professor	Biomaterials Polymer	Food Science and Technology	FT
9.	Peter NGENE	PhD Assistant Professor	Nanomaterials	Industrial Chemistry	PT
10.	Richard AMANKWAH	Ph.D. Professor	Mineral Processing	Mining and Minerals Engineering	PT
11.	Ali SALIFU	PhD Assistant Professor	Tissue Engineering	Biomedical Engineering	PT

12.	Abdulhakeem BELLO	PhD Assistant Professor	Energy StorageMaterials characterization	Physics	FT
13.	Abdulrahman Sikiru OTTAN	PhD Assistant Professor	Mining and Mineral Processing	Mining and Minerals Engineering	PT
14.	Kolawole Shola Kolade	PhD Assistant Professor	Composites	Materials Science and Engineering	FT
15.	Ngasoh Odette Fayen	PhD Assistant Professor	Corrosion	Materials Science and Engineering	FT
16.	Ezealigo Uchechukwu Stella	MSc, (PhD in View) Asst. Lecturer	Biomaterials	Materials Science and Engineering	FT
17.	Oparah Josephine	MSc, (PhD in View) Asst. Lecturer	Biomaterials	Materials Science and Engineering	FT
18.	Nwajozie, Clare	MSc, (PhD in View) Asst. Lecturer	Metallurgy	Materials Science and Engineering	FT
19.	Aina, Toyin	MSc, (PhD in View) Asst. Lecturer	Metallurgy	Materials Science and Engineering	FT
20.	Ezeala, Chukwudi	MSc, (PhD in View) Asst. Lecturer	Polymers	Materials Science and Engineering	FT
21.	Komadja, Charles	PhD Assistant Professor	Mining and Mineral Processing	Materials Science and Engineering	FT

FT – Full time PT – Part time

3.2 Library Facility

The library is the heart of teaching and research. The central library has a huge collection of books and bound periodicals. The department also has a departmental library. In order to facilitate all the readers in selecting the reading materials of their choice, the access to stacks is open to its members.

It works as nerve center of the institution by keeping the knowledge of students and faculty members updated. Information data bank is constantly updated and facilities are added. The central library is equipped with Ebscohost database, which contains large number of e-books and e-journals. Some e-journals are: ACM Transactions and IEEE Transactions etc. E-books are available for most of the international publishers.

3.3 ICT

The responsibilities of the Information and Communication Technology (ICT) unit comprise: the development and maintenance of the AUST ICT infrastructure; the provision of ICT advice for projects; the management of online services and databases.

3.4 Laboratory

AUST has two dedicated computer lab (20 computers each), one advanced lab (10 high configuration Apple computers) and one High performance computer (HPC), which provides computer services to the students. Computer labs are typically provided by libraries to the public, by academic institutions to

students who attend the institution, or by other institutions to the public or to people affiliated with that institution.

4.0 COURSE CONTENT/SYLLABUS

4.1 Course Structure for Materials and Metallurgical Engineering

Course Structure at 100 Level

Course Code	Course Title	Units	Status	LH*	PH*
GST 111	Communication in English I	2	C*	30	-
GST 112	Logic, Philosophy and Human Existence	2	R	30	-
GST 113	Nigerian Peoples and Culture	2	R	30	-
GST 121	Use of Library, Study Skills and ICT	2	C	30	-
GST 122	Communication in English II	2	C	30	-
GST 123	Basic Communication in French	2	E	30	-
GST 124	Basic Communication in Arabic	2	E	30	-
GST 125	Contemporary Health Issues	2	R	30	-
GET 111	Basic Engineering Drawing	2	C	15	45
CHM 101	General Chemistry I	3	C	45	-
CHM 102	General Chemistry II	3	R	45	-
CHM 107	General Practical Chemistry I	1	C	-	45
CHM 108	General Practical Chemistry II	1	R	-	45
MTH 101	Elementary Mathematics I	3	C	45	-
MTH 102	Elementary Mathematics II	3	R	45	-
PHY 101	General Physics I	3	C	45	-
PHY 102	General Physics II	3	R	45	-
PHY 107	General Practical Physics I	1	C	-	45
PHY 108	General Practical Physics II	1	R	-	45
TOTAL UNITS		**40**			

NOTE: C = Compulsory, E = Elective, R = Required, LH = Lecture Hours per semester PH = Practical Hours per semester

Course Structure at 200 Level – Common engineering courses

Course Code	Course Title	Units	Status	LH	PH
GST 211	Environment and Sustainable Development	2	R	30	-
GST 222	Peace and Conflict Resolution	2	R	30	-
GST 223	Introduction to Entrepreneurship	2	R	30	-
GST 224	Leadership Skills	2	R	30	-
GET 201	Applied Electricity I	3	C	45	-
GET 202	Applied Electricity II	3	C	45	-
GET 203	Engineering Drawing I	2	C	15	45
GET 222	Engineering Drawing II	2	C	15	45
GET 204	Students Workshop Experience	1	C	-	45
GET 205	Fundamentals of Fluid Mechanics	3	C	45	-
GET 206	Fundamentals of Thermodynamics	3	C	45	-
GET 207	Applied Mechanics	3	C	45	-
GET 208	Strength of Materials	3	C	45	-

GET 209	Engineering Mathematics I	3	R	45	-
GET 210	Engineering Mathematics II	3	R	45	-
GET 211	Computer Programming I	3	R	30	45
GET 212	Engineering Materials	3	R	45	-
GET 213	General Engineering Laboratory Course	1	R	-	45
GET 299	SIWES I	2	C	8 weeks	
TOTAL UNITS		**46**			

Course Structure at 300 Level

Course Code	**Course Title**	**Units**	**Status**	**LH**	**PH**
GET 301	Engineering Mathematics III	3	R	45	-
GET 302	Engineering Mathematics IV	3	R	45	-
GET 303	Engineer-in-Society	2	R	30	-
GET 304	Engineering Communication	2	R	30	-
GET 399	SIWES II	3	C	12 weeks	
GST 311	Entrepreneurship	2	C	30	-
MEE 308	Manufacturing Technology	2	R	30	-
MEE 310	Fluid Mechanics	2	R	30	-
MEE 312	Workshop Practice	2	R	15	45
MEE 331	Engineering Drawing III	3	C	30	45
MME 301	Thermodynamics of Materials	3	C	45	-
MME 302	Fundamentals of Foundry Processing	3	C	45	-
MME 304	Chemistry of Materials	3	C	45	-
MME 305	Engr. Materials: Structure and Properties	3	C	45	-
MME 307	Laboratory Practicals	3	R	-	135
MTE 304	Mineral Processing	3	C	45	-
MTE 305	Metal Deformation Process	2	R	30	-
MTE 306	Physical Metallurgy	2	C	30	-
MTE 309	Computer Application in Metallurgical Engr.	3	R	45	-
TOTAL UNITS		**49**			

Course Structure at 400 Level

Course Code	**Course Title**	**Units**	**Status**	**LH**	**PH**
GET 499	SIWES III	6	C	24 weeks	
MME 401	Synthesis, Processing, and Manufacturing of Materials	3	C	45	-
MME 402	Hydrometallurgy and Chemical Processing	3	C	45	-
MME 403	Engineering Materials Laboratory	2	C	30	-
MME 404	Materials Engineering Design	2	C	30	-
MME 405	Corrosion Science and Engineering	3	C	45	-
MME 406	Chemical Metallurgy	3	R	45	-

MME 407	Mechanical Behaviour of Materials	3	C	45	-
MME 408	Laboratory Practicals	3	R	-	135
TOTAL UNITS		**28**			

Course Structure at 500 Level

Course Code	**Course Title**	**Units**	**Status**	**LH**	**PH**
GET 501	Engineering Management	3	R	45	-
GET 502	Engineering Law	2	R	30	-
MEE 508	Engineering Design Process	3	C	45	-
MME 501	Analytical Methods for Materials	2	C	30	-
MME 502	Thermodynamics and Phase Equilibria	3	C	45	-
MME 503	Powder Technology	2	C	30	-
MME 504	Polymer Materials Engineering	3	R	45	-
MME 514	Laboratory Practicals	3	R	-	135
MTE 506	Electrical Systems and Controls for Materials	3	R	30	45
MTE 507	Transport Phenomenon in Metallurgy	3	C	45	-
MTE 508	Steels and their Treatment	3	C	45	-
TCE 510	Glass Science and Engineering	3	E	45	-
TCE 511	Principles of Engineering Materials	3	R	45	-
MME 510	Project	6	C	-	270
TOTAL UNITS		**42**			

COURSES SYNOPSES

GST 111: Communication in English I (2 Units: LH 30)

Effective communication and writing in English Language skills, essay writing skills (organization and logical presentation of ideas, grammar and style), comprehension, sentence construction, outlines and paragraphs.

GST 112: Logic, Philosophy and Human Existence (2 Units: LH 30)

A brief survey of the main branches of Philosophy; Symbolic logic; Special symbols in symbolic logic-conjunction, negation, affirmation, disjunction, equivalent and conditional statements, law of tort. The method of deduction using rules of inference and bi-conditionals, qualification theory. Types of discourse, nature or arguments, validity and soundness, techniques for evaluating arguments, distinction between inductive and deductive inferences; etc. (Illustrations will be taken from familiar texts, including literature materials, novels, law reports and newspaper publications).

GST 113: Nigerian Peoples and Culture (2 Units: LH 30)

Study of Nigerian history, culture and arts in pre-colonial times; Nigerian's perception of his world; Culture areas of Nigeria and their characteristics; Evolution of Nigeria as a political unit; Indigene/settler phenomenon; Concepts of trade; Economic self-reliance; Social justice; Individual and national development; Norms and values; Negative attitudes and conducts (cultism and related vices); Re-orientation of moral; Environmental problems.

GST 121: Use of Library, Study Skills and ICT (2 Units: LH 30)

Brief history of libraries; Library and education; University libraries and other types of libraries; Study skills (reference services); 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.).

GST 122: Communication in English II (2 Units: LH 30)

Logical presentation of papers; Phonetics; Instruction on lexis; Art of public speaking and oral communication; Figures of speech; Précis; Report writing.

GST 123: Basic Communication in French (2 Units: LH 30)

Introduction to French, Alphabets and numeracy for effective communication (written and oral), Conjugation and simple sentence construction based on communication approach, Sentence construction, Comprehension and reading of simple texts.

GST 124: Basic Communication in Arabic (2 Units: LH 30)

Introduction to Arabic alphabets and writing systems. Elementary conversational drills. Basic reading skills and sentence construction in Arabic.

GST 125: Contemporary Health Issues (2 Units: LH 30)

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

GET 111: Basic Engineering Drawing (2 Units: LH 15; PH 45)

Introduction to Engineering Drawing as a means of communication. Drawing paper format. Use of drawing instruments. Types of lines and their uses in Engineering Drawing. Circles and tangent. Circles to satisfy conditions involving other circles, lines and points. Conic sections, various methods of their construction. Cycloid, epi and hypocycloids. 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). (Orthographic – Multi-view, two views, three views, auxiliary views). (Axonometric – Isometric, dimetric, trimetric). Multiview representation. 1st and 3rd angle representations. Isometric drawing. Oblique drawings. Revisions.

CHM 101: General Chemistry I (3 Units: LH 45)

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

CHM 102: General Chemistry II (3 UNITS: LH 45)

Historical survey of the development and importance of Organic Chemistry; Electronic theory in organic chemistry. Isolation and purification of organic compounds. Determination of structures of organic compounds including qualitative and quantitative analysis in organic chemistry. Nomenclature and functional group classes of organic compounds. Introductory reaction mechanism and kinetics.

Stereochemistry. The chemistry of alkanes, alkenes, alkynes, alcohols, ethers, amines, alkyl halides, nitriles, aldehydes, ketones, carboxylic acids and derivatives. The Chemistry of selected metals and non-metals. Comparative chemistry of groups IA, IIA and IVA elements. Introduction to transition metal chemistry.

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

Laboratory experiments designed to reflect the topics taught in CHM 101 and CHM 102 such as qualitative and quantitative chemical analysis, acid-base titrations. Gravimetric analysis. Calculation, data analysis and presentation. Functional group analysis.

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

Continuation of laboratory experiments designed to reflect the topics taught in CHM 101 and CHM 102. Some of the experiments will have been carried out in CHM 107.

MTH 101 General Mathematics I (3 Units: LH 45) (Algebra and Trigonometry)

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

MTH 102 General Mathematics II (3 Units: LH 45) (Calculus)

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

PHY 101 General Physics I (3 Units: LH 45) (Mechanics, Thermal Physics and Waves)

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

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

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 107 General Practical Physics I (1 Unit: PH 45)

This introductory course emphasizes quantitative measurements, the treatment of measurement errors, and graphical analysis. A variety of experimental techniques will be employed. The experiments include studies of meters, the oscilloscope, mechanical systems, electrical and mechanical resonant systems, light, heat, viscosity, etc., covered in PHY 101 and PHY 102. However, emphasis should be placed on the basic physical techniques for observation, measurements, data collection, analysis and deduction.

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

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

GST 211 Environment and Sustainable Development (2 Units: LH 30)

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

GST 222 Peace and Conflict Resolution (2 Units: LH 30)

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

GST 223 Introduction to Entrepreneurship (2 Units: LH 30)

Introductory Entrepreneurial skills: Relevant Concepts: Enterprise, Entrepreneur, Entrepreneurship, Business, Innovation, Creativity, Enterprising and Entrepreneurial Attitude and Behaviour. History of Entrepreneurship in Nigeria. Rationale for Entrepreneurship, Creativity and Innovation for Entrepreneurs. Leadership and Entrepreneurial Skills for coping with challenge. Unit Operations and

Time Management. Creativity and Innovation for Self-Employment in Nigeria. Overcoming Job Creation Challenges. Opportunities for Entrepreneurship, Forms of Businesses, Staffing, Marketing and the New Enterprise. Feasibility Studies and Starting a New Business. Determining Capital Requirement and Raising Capital. Financial Planning and Management. Legal Issues, Insurance and Environmental Considerations. Also to be incorporated, on the other side of the spectrum, are employability skills – interview techniques, Oral Presentation Skills, etc.

GST 224 Leadership Skills (2 Units: LH 30)

Transformation is a fundamental shift in the deep orientation of a person, organization or society such that the world is seen in new ways and new actions and results become possible that were impossible prior to the transformation. Transformation happens at the individual level but must be embedded in collective practices and norms for the transformation to be sustained. Leadership Development Programme (LDP) proposes novel approaches to teaching and learning, which emphasizes the practical involvement of participants. It is interactive and involves exercises and actual implementation of breakthrough projects by teams that make difference in the lives of the target population. In this course, leadership concepts comprising of listening, conversation, emotional intelligence, breakthrough initiatives, gender and leadership, coaching and leadership, enrolment conversation and forming and leading teams will be taught.

GET 201 Applied Electricity (3 Units: LH 45)

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

GET 202 Applied Electricity II (3 Units: LH 45)

Basic machines – DC, synchronous alternators, transformers, equivalent circuits. Three phase balanced circuits, PN junction Diode, Transistors, Thyristors FETs, Zener, Rectifiers. Basic control systems, open/closed loop systems. Communications fundamentals, introduction of TV, Radio, Telephone systems.

GET 203 Engineering Drawing I (2 Units: LH 15; PH 45)

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 degrees). Dimensioning. Sections and Conventions. Auxilliary views. Representation and specification of threads. Bolted joints. Keys and cottered joints. Conventional representations (see BS 308).

GET 222: Engineering Drawing II (2 Units: LH 15; PH 45)

Cams. Interpretation of solids. Development of surfaces. Detail drawing. Belts, Chains, Gears. Bearing and lubrication arrangements. Couplings brakes, Flexible shafts, Universal joints, etc. Assembly drawings. Revisions.

GET 204 Students Work Shop Experience (1 Unit: PH 45)

Introduction to practices and skills in general engineering through instruction in operation of hand and powered tools for wood and metal cutting and fabrication. Supervised hands on experience in safe usage of tools and machines for selected tasks.

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

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

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

Basic concepts, quantitative relations of Zeroth, first, second and third laws of thermodynamics. Behaviour of pure substances and perfect gases. Ideal gas cycles.

GET 207 Applied Mechanics (3 Units: LH 45)

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

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

Consideration of equilibrium; composite members, stress-strain relation. Generalized Hooke's law. Stresses and strains due to loading and temperature changes. Torsion of circular members. Shear force, bending moments and bending stresses in beams with symmetrical and combined loadings. Stress and strain transformation equations and Mohr’s circle. Elastic buckling of columns.

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

Limits, Continuity, differentiation, introduction to linear first order differential equations, partial and total derivatives, composite functions, matrices and determinants, Vector algebra, Vector calculus, Directional Derivatives.

GET 210 Engineering Mathematics II (3 Units: LH 45)

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

GET 211 Computer Programming I (3 Units: LH 30; PH 45)

Introduction to computers and computing. Problems solving on computer algorithm, design using flowchart and pseudo-code. Introduction to high level programming languages, Basic and FORTRAN syntax, flow of control, input/output constructs, data types. Programming in FORTRAN. Extensive exercises in solving engineering problems using flowchart and pseudo-code.

GET 212 Engineering Materials (3 Units: LH 45)

Introduction to electronic configuration, atomic structures, inter-atomic bonding mechanisms, crystal and microstructure. Relationships between structure and properties of metals, alloys, ceramics and plastics. Principles of the behaviour of materials in common environments. Fabrication processes and applications.

GET 213 General Engineering Laboratory Course (Unit 1: PH 45)

Laboratory investigation and report submission for selected experiments and projects in Thermodynamics, Applied Mechanics and Applied Electricity and Fundamentals of Fluid Mechanics.

GET 299 Students Industrial Work Experience (2 Units: 8 weeks)

On the job experience in industry chosen for practical working experience but not necessarily limited to the student's major (8 weeks during the long vacation following 200 level).

MME 301 Thermodynamics of Materials (3 Units: LH 45)

Thermochemistry applied to typical metallurgical reactions, graphical representations of equilibria, binary and ternary phase diagrams, heterogeneous equilibrium, behaviour of solutions, standard states, and electrochemical thermodynamics.

MME 302 Fundamentals of Foundry Processing (3 Units: LH 45)

Metal-casting principles including pattern design, moulding materials, moulding methods, sand testing, solidification, rise ring and gating of castings, casting design, and casting defects.

MME 304 Chemistry of Materials (3 Units: LH 45)

Basic Inorganic Chemistry of Materials. Topics will include chemical properties, structure and bonding of solids, energy, enthalpy, entropy, thermochemistry, kinetics and rate processes. Application of chemistry principles to materials engineering through flowsheeting, reactor design, materials/ metals processing and the environment.

MME 305 Engineering Materials: Structure and Properties (3 Units: LH 45)

Basic structure of ceramics, alloys, composites, metals, and polymers. Relationships between the structure of materials and their mechanical, electrical, magnetic, thermal, and chemical properties.

GST 311 Entrepreneurship (2 Units: LH 30)

Profiles of business ventures in the various business sectors such as: Soap/Detergent, Tooth brush and Tooth paste making; Photography; Brick making; Rope making; Brewing; Glassware production/ Ceramic production, Paper production; Water treatment/conditioning/packaging; Food processing/preservation/packaging; Metal fabrication; Tanning 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 Case presentations.

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

Linear Algebra. Elements of Matrices, Determinants, Inverses of Matrices, Theory of Linear Equations, Eigen Values and Eigen Vectors. Analytical Geometry, Coordinate Transformation, Solid Geometry, Polar, Cylindrical and Spherical Coordinates. Elements of Functions of Several Variables, Surface Variables. Ordinary Integrals, Evaluation of Double Integrals, Triple Integrals, Line Integrals and Surface Integrals. Derivation and Integrals of Vectors, The Gradient of Scalar quantities. Flux of Vectors, The Curl of a Vector Field, Gauss, Greens and Stoke's Theorems and Applications. Singular Valued Functions. Multivalued Functions, Analytical Functions, Cauchy Riemann's Equations. Singularities and Zeroes, Contour Integration including the use of Cauchy's Integral Theorems, Bilinear Transformation.

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

Series solution of second order linear differential equations with variable coefficients. Bessel and Legendre equations. Equations with variable coefficients. Sturn-Louville boundary value problems. Solutions of equations in two and three dimensions by separation of variables. Eigen value problems. Use of operations in the solution of partial differential equations and Linear integral equations. Integral transforms and their inverse including Fourier, Laplace, Mellin and Handel Transforms. Convolution integrals and Hilbert Transforms. Calculus of finite differences. Interpolation formulae. Finite difference

equations. RungeKutta and other methods in the solutions of ODE and PDEs. Numerical integration and differentiation.

GET 303 Engineering in Society (2 Units: LH 30)

Philosophy of Science and Engineering. History of Engineering and Technology. The Engineering profession - engineering - engineering literacy professional bodies and engineering societies. Engineers' code of conduct and ethics. Engineers and nation building - economy, politics, business, safety in Engineering and introduction in Risk analysis, invited lecturers from professionals.

GET 304 Engineering Communication (2 Units: LH 30)

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 industrial failures; professional presentation of reports and proposals.

STA 305 Statistics for Physical Sciences and Engineering (3 Units: LH 45)

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

MEE 331 Engineering Drawing (3 Units: LH 15 ; PH 90)

Introduction to AUTOCAD. Use of AUTOCAD for 2-D and 3-D drawings. Descriptive geometry. Limits and fits. Geometric tolerancing. Welding drawing and design. Redesigning of casts components using welded joints. Harder examples on exploded assembly drawing (e.g. a complete gear box in exploded assembly drawing). Pipe joints. Arrangement of engineering components to form a working plant (Assembly Drawing of a Plant). Revision.

GET 399 Students Industrial Work Experience II (3 Units: 12 weeks)

On the job experience in industry chosen for practical working experience but not necessarily limited to the student's major (12 weeks during the long vacation following 300 level).

MME 401 Synthesis, Processing, and Manufacturing of Materials (3 Units: LH 45)

Detailed study of principal alloy, ceramic, and polymer systems. Evaluation of the effects or processing on selected physical and mechanical material properties. Overview of design fundamentals and examination of selected material/design case studies for manufacturing.

MME 402 Hydrometallurgy and Chemical Processing (3 Units: LH 45)

Current hydrometallurgical practice as applied to mineral processing, metal extraction, and recovery; recent developments in technology; thermodynamics and kinetics of hydrometallurgical processes; leaching and solvent extraction.

MME 403 Engineering Materials Laboratory (2 Units: LH 90)

Materials testing and evaluation, laboratory procedures and techniques, metallography, heat treatment, phase diagrams, hardenability, and mechanical testing.

MME 404 Materials Engineering Design (2 Units: LH 30)

Design of devices, components, processes or systems using physical, chemical, mechanical, economic, and ethical principles. Project planning and cost analysis. Application of computer-based design tools. Analysis of problems, design and development of solutions. Concepts of shared responsibility, teamwork, and communication. Oral and written presentations.

MME 405 Corrosion Science and Engineering (3 Units: LH 45)

The course is aimed at investigating the underlying 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.

MME 406 Chemical Metallurgy (3 Units: LH 45)

Application of thermodynamics, fluid flow, and heat and mass transfer to the design and operation of chemical metallurgical processes; roasting, agglomerating, oxidation and reduction reactions, smelting, converting, and refining.

MME 407 Mechanical Behaviour of Materials (3 Units: LH 45)

Flow and fracture of solids; uniaxial stress-strain as a reference behaviour; theories of terminal stability under impact; monotonic, sustained (creep), and repeated (fatigue) loadings of solids under various states of stress.

GET 499 Students Industrial Work Experience III (6 Units: 24 weeks)

On the job experience in industry chosen for practical working experience but not necessarily limited to the student's major (24 weeks from the end of the First Semester at 400-Level to the beginning of the First Semester of the following session. Thus, the second semester at 400-Level is spent in industry.)

MME 501 Analytical Methods for Materials (2 Units: LH 30)

Crystallography, physics of X-rays, diffraction by crystalline materials, applications of X-ray, electron and neutron diffraction, and spectrometric analysis of materials.

MME 502 Thermodynamics and Phase Equilibria (3 Units: LH 45)

Application of thermodynamic data to predict stable phases in aqueous and high- temperature systems. Construction and use of partial pressure diagrams, Eh-pH diagrams, temperature-composition diagrams in related mineral and metallurgical systems. Activities and equilibria in slag-metal and gas-metal systems.

MTE 503 Powder Metallurgy (2 Units: LH 30)

The course will cover the topic of powder metallurgy, describing the various types of powder processing and how these affect properties of the components made. Current issues in the subject area, from high production to nanomaterials, will be discussed.

MME 504 Polymer Materials Engineering (3 Units: LH 45)

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.

GET 501 Engineering Management (3 Units: LH 45)

Principles of organization; elements of organization; management by objectives. Financial management, accounting methods, financial statements, cost planning and control, budget and budgetary control. Depreciation accounting and valuation of assets. Personnel management, selection, recruitment and training, job evaluation and merit rating. Industrial psychology. Resource management; contracts, interest formulae, rate of return, Methods of economic evaluation. Planning decision making; forecasting, scheduling. Production control. Gantt Chart, CPM and PERT. Optimization, linear 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.

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

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.