DEPARTMENT HANDBOOK

Bachelor of Engineering [B.Eng.]

in

MECHANICAL 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 MECHANICAL ENGINEERING PROGRAMME

The Mechanical Engineering Department offers undergraduate degree in mechanical engineering. Our degree programs provide a strong theoretical background as well as practical experience gained through projects and hands-on research. Our undergraduate programs provide students with the skills required for a broad range of jobs in industry, government, academia, business, and research. We begin with a strong foundation in mathematics and add a wide spectrum of courses on the fundamentals of engineering mechanics, thermodynamics, fluid mechanics, and engineering design. Each of the degree programs provides a broad spectrum of knowledge in the field and allows for specialization through electives, independent research projects, and learning abroad opportunities. The undergraduate degree includes several options for capstone design experience in the final year of study. The program also provides a broad general education necessary to put technical knowledge into perspective.

Since the inception of the university in 2007, some aspects of Mechanical Engineering have been mounted under the Materials Science and Engineering programme especially in the area of Energy. Therefore, the proposed Mechanical Engineering department will be nurtured by the existing Materials Science and Engineering which already has NUC and HCERES accreditation for MSc and PhD

2.1 Mission

The Mechanical Engineering Department's mission for undergraduate education is to provide a thorough education in mechanical and aerospace engineering combined with intensive training in mathematics and complimented by experimental hands-on engineering and technology through investigative laboratory work and classroom lecture/demonstrations, all of which would allow a graduate to function effectively in the industry or continue on to postgraduate school.

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 Mechanical 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:

- Solid Mechanics (analyzing the behavior of solid bodies subjected to external loads, stress, and/or vibrations and using that information in the design and manufacture/construction of such bodies)
- Fluid Mechanics (analyzing the behavior of liquids and gases and using that knowledge in the design and development of machinery and systems that can and/or do influence that behavior – pumps, fans, turbines, piping systems, etc.)
- Thermodynamics (analyzing the conversion one form of energy into another and using that knowledge to design and develop energy conversion devices and systems – power plants, engines, Heating, Ventilation, and Air Conditioning (HVAC) systems, etc.)
- Mechanical Design (covering the full range of mechanical-based products and systems)
- Energy

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 Mechanical 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 Mechanical 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 below:

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 x GP_1
C_2	U_2	GP_2	U_2 x GP_2
-	-	-	-
-	-	-	-
C_i	U_i	GP_i	U_i x GP_i
-	-	-	-
-	-	-	-
C_N	U_N	GP_N	U_N x 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 Mechanical 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 Mechanical 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	2		2				1	2
Staff available for the programme from other source (s)		1	2	2					
Total	1	3	2	4				1	2

Table 4: List of Existing Academic Staff for The Programme

S/N	Name	Qualification/ Rank	Areas of Specialization	Discipline	Status
1.	Onwualu Peter Azikiwe	PhD/Professor	Power and Machinery, Energy	Agricultural Engineering	(FT)
2.	Olufemi Agboola	PhD/Associate Professor	Aerospace Engineering	Aerospace Engineering	FT Coordinator
3.	Afolayan David Oluwasegun	PhD/Lecturer II	Mineral Processing, Materials characterisation	Materials Science and Engineering/Chemical Engineering	FT/Acting HOD
4.	Anye Odette	PhD/Lecturer II	Mechanics and Materials characterisation	Materials Science and Engineering	FT
5.	Anye Vitalis	PhD/Assistant Professor	Energy	Materials Science and Engineering	FT
PART-TIME LECTURERS					
6.	Attah Ileh Benjamin	PhD/Lecturer II	Advanced manufacturing, Welding, and corrosion	Mechanical Engineering	PT
7.	Anosike Esther	PhD/Lecturer II	Materials Science and Engineering (Machines)	Mechanical Engineering	PT
8.	Emmanuel Onche	PhD/Senior Lecturer	Materials Science and Engineering (Fracture Mechanics)	Mechanical Engineering	PT
9.	Blessing Ekwe	PhD/Senior Lecturer	Biomechanics	Chemical Engineering	PT

12.	Adedeji Adewoye	PhD/Associate Professor	Mechanical Engineering	Mechanical Engineering	PT

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 Mechanical 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**
EEE 305	Electrical Machines	4	R	60	-
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 307	Theories of Machines I	3	C	45	-
MEE 308	Manufacturing Technology	2	R	0	-
MEE 309	Thermodynamics	3	C	45	-
MEE 310	Fluid Mechanics I	2	C	30	-
MEE 312	Workshop Practice	2	R	5	5
MEE 313	Engineering Metallurgy	2	R	30	-
MEE 315	Control Systems	3	R	45	-
MEE 316	Laboratory Practicals	6	R	-	270
MEE 321	Mechanics of Materials	3	C	45	-
MEE 322	Metrology	3	R	5	-
MEE 331	Engineering Drawing III	3	C	45	45
TOTAL UNITS		**51**			

Course Structure at 400 Level

Course Code	**Course Title**	**Units**	**Status**	**LH**	**PH**
GET 499	SIWES III	6	C	24 weeks	
MEE 403	Applied Thermodynamics and Heat Transfer	4	C	45	45
MEE 404	Theory of Machines II	3	C	30	45
MEE 405	Fluid Mechanics II	3	C	30	45
MEE 406	Machine Design I	3	C	45	-
MEE 408	Advance Mechanics of Materials	3	R	45	-
STA 305	Statistics for physical Science and Engineering	3	R	45	-
TOTAL UNITS		**25**			

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 501	Applied Thermodynamics	3	C	30	45
MEE 502	Fluid Dynamics	3	C	45	0
MEE 503	Heat Transfer	3	C	30	45
MEE 504	Machine Design II	4	C	30	90
MEE 505	Project	6	C	30	270
MEE 506	Laboratory Practicals	3	C	-	135
MEE 507	Theory Elasticity	4	C	-	45
MEE 508	Engineering Design Process	2	C	45	-
MEE 509	Fracture of Structural Materials	4	C	30	45
MEE 510	Plasticity	2	E	45	-
MEE 511	Tribology	2	E	30	-
MEE 512	Turbomachinery	2	E	30	-
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 Elementary 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 Elementary 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).

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 III (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).

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.)

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

MEE 309 Thermodynamics (3 Units: LH 45)

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

MEE 307 Theories of Machines I (3 Units: LH 45)

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

MEE 310 Fluid Mechanics I (2 Units: LH 30)

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

MEE 313 Engineering Metallurgy (2 Units: LH 30)

Introduction to the electric structure of atom and matter. Solid state crystallography. Relationship between structure and composition and the mechanical and thermal properties of materials of metals, alloys, plastics, ceramics, and natural products. Heat treatment: Annealing, normalizing, tempering and hardening. Metallic corrosion and protection. Manufacture and properties of high polymers. Thermoplastic and thermosetting resins.

MEE 331 Engineering Drawing III (3 Units: LH 30; PH 45)

Introduction to AutoCAD. Using AutoCAD to produce 2-D and 3-D drawing. 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.

MEE 308 Manufacturing Technology (2 Units: LH 30)

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

MEE 312 Workshop Practice (2 Units: LH 15; PH 45)

Workshop setting; Types of workshop equipment, machines and materials; Use of instruments and tools, Machine operation practice; Safety procedures in workshops.

MEE 315 Control Systems (3 Units: LH45)

Control Engineering concepts; Transfer function; Differential Equation of control Systems; Transducers; Automatic control methods.

MEE 321 Mechanics of Materials (3 Units: LH 45)

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

MEE 322 Metrology (3 Units: LH 45)

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

MEE 403 Applied Thermodynamics & Heat Transfer (4 Units: LH45; PH45)

General thermodynamics relations. Kinetic theory of gas. Mixture of gases, psychometry, air-conditioning and cooling towers. Introduction to heat transfer.

MEE 404 Theory of Machines II (3 Units: LH 30; PH 45)

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

MEE 405 Fluid Mechanics II (3 Units: LH 30; PH 45)

Unsteady flow; Oscillation in U-tube; Surge tank; Water hammer. Open-channel flows. Introductory concepts of boundary layer and re-circulating flows, Mathematical derivation of Navier-stokes equations and its application.

MEE 406 Machine Design I (3 Units: LH 45)

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

MEE 408 Advanced Mechanics of Materials (3 Units: LH 45)

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

MEE 501 Applied Thermodynamics (3 Units: LH 30; PH 45)

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

MEE 502 Fluid Dynamics (3 Units: LH: 45)

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

MEE 503 Heat Transfer (3 Units: LH 30; PH 45)

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

MEE 504 Machine Design II (4 Units: LH 30; PH 90)

Creative Application of the design process to engineering problems with emphasis on the manufacture of complete systems to accomplish overall objectives of minimum weight, high efficiency while satisfying the design constraints. Use and evaluation of several CAD/CAM software packages. Students will gain experience with CAD/CAM software while carrying out an actual manufacturing design project.

MEE 507 Theory Elasticity (4 Units: LH 45; PH 45)

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

MEE 508 Engineering Design Process (2 Units: LH 30)

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

MEE 509 Fracture of Structural Materials (4 Units: LH 45; PH 45)

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

MEE 510 Plasticity (2 Units: LH 30)

Fundamentals of plasticity; Stress and strain relations; Yield criteria. Various approximate methods applied to elastoplastic problems of bending of beams and torsion and bars. Plastic limit design.

MEE 511 Tribology (2 Units: LH 30)

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

MEE 512 Turbomachinery (2 Units: LH 30)

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