IGBINEDION UNIVERSITY, OKADA

GEN. ABDULSALAMI A. ABUBAKAR COLLEGE OF ENGINEERING

DEPARTMENT OF PETROLEUM ENGINEERING HANDBOOK FOR UNDERGRADUATE PROGRAMME

2021/2022 - 2025/2026 SESSIONS

FORWARD

This edition of the Handbook for Petroleum Engineering Undergraduate Programme aims at presenting vital information on the structure of the Department of Petroleum Engineering, the vision and mission. It also includes course description, other relevant matters and extracts from the University Regulations Governing First Degree Programmes.

This handbook will be of great value to students and staff of the department and other persons who may wish to obtain information on the academic programmes of the department

Ag. Head of Department

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PETROLEUM ENGINEERING DEPARTMENT

1.0 INTRODUCTION AND GENERAL PHILOSOPHY

1.1 Introduction/ Philosophy

Petroleum Engineering is the application of principles of fundamental Sciences, Engineering, Economics, Computer Technology, Human relations to exploring and exploiting the subsurface for oil and gas. It deals with processes and equipment which are used to ensure that exploration and exploitation is done in an economic and safe manner. Training in Petroleum engineering requires the provision of knowledge, skill and understanding of these principles, for developing and producing oil and gas fields in such a manner as to obtain a high economic recovery. The aim of running Petroleum Engineering programme is to produce graduates that are suitable for employment in oil and gas industry as production engineers, drilling engineers, reservoir engineers and petroleum engineers.

The general philosophy of the department of Petroleum Engineering is to produce graduates who are knowledgeable with high academic standard, that can be self-employed and of immense value to industry in particular and the nation in general. This is in line with the minimum academic standards set by Council for the Regulation of Engineering in Nigeria (COREN) and National Universities Commission (NUC),

The programme has four-intervening Industrial-Training periods to enable the engineering graduates acquire the necessary skills to solve local/international problems. Pursuant to the general philosophy, the programme has been designed to incorporate the following features:

i. Common courses at the 100 and 200 levels for all engineering students
ii. 8 weeks workshop practical at the end of the 2nd semester 100 level and 200 level examinations for all engineering students (IUITS 102 and IUITS 202 respectively).
iii. Workshop practice (up to 300 Level) and, laboratory work for all engineering students.
iv. Industrial Training (IUITS 302) runs for 12 weeks for all 300 level engineering students
v. Industrial Training (IUITS 402) runs for 24 weeks for all 400 level engineering students.
vi. Interaction between students and professionals through regular seminars
vii. Final year research project where the student works alone under an academic supervisor
viii. Opportunity to have in-depth study of a specific area of the programme from a wide selection of optional courses.
ix. Adequate knowledge in engineering management and entrepreneurship

1.2 PETROLEUM ENGINEERING DEPARTMENT MISSION AND VISION

Vision:

The vision of the department is to become one of the best Petroleum Engineering Department in Nigeria, where the advancement of engineering and technology is continuously dynamic. Producing highly skilled, knowledgeable graduates who are capable of proffering innovative and lasting solutions to industrial challenges in the public and private sectors of the economy. Hence contributing to rapid industrialization and development of Nigeria.

Mission

The Departmental Mission is to develop a national resource that will continue to support the development of Nigeria, its economic diversification to make it responsive to the needs of government, industry and society.

1.3. PROGRAMS EDUCATIONAL OBJECTIVES (PEO'S)

Programs educational objectives is what the program is preparing graduates for in their career and professional life. Our current PEOS are hinged on problem solving, competency, commitment to sustainable development, leadership, teamwork, lifelong learning in innovation and research.

The PEO's for petroleum engineering programme are as follows

i. Demonstrate in depth knowledge and skills in the field of Petroleum Engineering and are committed to lifelong learning in research and innovation

ii. Highly competent graduate who are resourceful, creative and will actively engage in problem-solving using petroleum engineering principles to address the evolving needs of industry and society

iii. Execute and manage teamwork, display leadership, interpersonal skills and are committed to professional growth while considering environmental, cultural, ethical, health and safety aspect.

1.4. PROGRAMME SPECIFIC OBJECTIVES (PSO)

The general goal of engineering training are expected to be in consonance with the realization of national desires with respect to industrial development and high technology attainment. Consequently, the objectives of the engineering programme are to:

a. Develop the necessary skills, creative ability, attitudes and expertise consistent with engineering design, communication and construction of engineering works and projects;
b. Adapt and improve on exogenous technology in order to enhance constructive techniques and the proper study in the use of local raw materials;
c. Inculcate maintenance culture in the use of engineering artifacts;
d. Inculcate a responsible attitude towards demands made by the practice of engineering and risk implication of design and construction;
e. Install and maintain complex engineering systems to enable them perform optimally in the Nigerian environment;
f. Be able to exercise original thought, have good professional judgment and be able to take responsibility for the direction of important assignments;
g. Be self-employable;
h. Ensure, therefore, that engineering graduates from Igbinedion University are resourceful, creative, knowledgeable and capable of carrying out the following functions:
    i. To design oil and gas engineering projects and supervise their construction;

ii. To design and make components, machines, equipment and systems relevant to the petroleum industry ;
iii. To develop new models, products and production techniques in the petroleum industry;
iv. To be good managers of people, money, material, plants and machinery.

1.5. PROGRAMME'S OUTCOME (PO)

A graduate of Petroleum engineering programme to be accredited by COREN is expected to have the following :

i. **Engineering Knowledge**: apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of developmental and complex engineering problems;
ii. **Problem Analysis**: identify, formulate, research literature and analyze developmental and complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences;
iii. **Design/Development of Solutions**: proffer solutions for developmental or complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal and environmental considerations;
iv. **Investigation**: conduct investigation into developmental or complex problems using research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions;
v. **Modern Tool Usage**: create, select and apply appropriate techniques, resources and modern engineering and ICT tools, including prediction, modelling and optimization to developmental and complex engineering activities, with an understanding of the limitations;
vi. **The Engineer and Society**: apply reasoning informed by contextual knowledge including Humanities and Social Sciences to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice;
vii. **Environment and Sustainability**: understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development;
viii. **Ethics**: apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice
ix. **Individual and Team Work**: function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings
x. **Communication**: communicate effectively on developmental or complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions;

xi. **Project Management**: demonstrate knowledge and understanding of engineering, management and financial principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

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

1**.6. SPECIFIC REQIUREMENTS TO ACHIEVE GOALS AND OBJECTIVE**

In order to achieve the goals and objectives set out above, and taking into consideration the broad-based approach to engineering education and training, we therefore made the following recommendations:

1.6.1. **Academic Staff:**

Efforts should be made to ensure that the Nigerian University Commission (NUC) and Council for Registered Engineers in Nigeria (COREN) guidelines on staff-student ratio of 1:15 is maintained. In the same vein, each department should have a minimum of six full-time equivalents of staff on ground. The need to recruit some staff with Ph.D. degrees as well as industrial experience cannot be over-emphasized. The entry qualifications of staff seeking academic placement in the College, as recommended by the NUC are reproduced below with slight modifications:

(i) Graduate Assistant: Candidates must have an Honor's Degree in the appropriate discipline with at least a Second Class (Lower pass), and should have completed the National Youth Corps Service, where applicable.

(ii) Lecturer II: Candidates must have a degree of Master in the appropriate discipline plus at least two years of cognate experience.

(iii) Lecturer I: Candidates should normally have Ph.D. Degree with at least one year of teaching or industrial experience, plus one scholarly publication. However, where a candidate does not possess a PhD, but has a degree of Master with sufficient industrial experience, acceptable for professional registration, such a candidate, who should also show evidence of research potential, may be considered.

(iv) Senior Lecturer: Candidates should normally possess a PhD. Degree and/or research experience and/or industrial experience. Such candidates should also have six (6) scholarly publications, four (4) of which must be journal articles. The other two (2) may be referred Proceedings or Technical Reports. The candidates should also be registered with their professional bodies (COREN, etc.).

(v) Associate Professor: Candidates should normally possess a PhD. Degree with teaching and research experience. Such candidates should possess the ability of providing academic leadership in addition to having a considerable number of referred journal publications (not less than 12), that must be assessed externally.

(vi) Professor: Candidates should normally possess a PhD Degree, with teaching and research experience. They should have demonstrable ability to provide virile academic leadership in addition to a considerable number of referred journal articles that must be externally assessed.

1.6.2. Technical Staff:

The services of very competent senior technical staff are required to run laboratories, workshop/studios, and maintain teaching and research equipment. The requisite qualification and experience are presented below for each category of technical staff:

i. Assistant Technical Officer:
Candidates should possess an Ordinary National Diploma in the appropriate discipline.

ii. Technical Officer II/Technologist II Candidates should possess a Higher National Diploma with at least two (2) years cognate experience, or a City and Guilds Certificate with at least four (4) years cognate experience.

iii. Senior Technical Officer/Technologists:
As above, but with at least six (6) years and eight (8) years cognate experience as per qualification respectively.

iv. Principal Technical Officer/Technologist:
As above, but with at least eight (8) years and ten (10) years cognate experience, respectively.

v. Assistant Chief Technical Officer/Technologist:
As above, but with at least twelve (12) years, and fourteen (14) years cognate experience, respectively.

vi. Chief Technical Officer/Technologist:
As above, but with at least fourteen (14) years and sixteen (16) years cognate experience, respectively.

1.7 HISTORY OF THE DEPARTMENT OF PETROLEUM ENGINEERING

The Petroleum Engineering programme started in September, 2004 with a student population of 11 and staff strength of two. Over the years, the department has made tremendous progress both locally and internationally. The student population is currently 65**.** The department has eight (8) highly qualified academic staff, 6 are full-time, one (1) Adjunct Professor (1) adjunct Senior lecturer. It also has two (2) full-time and two part time technical staff. The Department has an e-library, Simulation laboratory, departmental Library and furnished lecturer's offices. Each lecturer has a personal computer (PC), and the students have access to computers and receive further training in both the University's and college Computer Laboratories. The Petroleum Engineering Programme Society of Petroleum Engineering (SPE) student chapter has won various awards including three-time consecutive Winner of African Petro bowl Competition for Petroleum Engineering Students and African's Representative at the Global Petro bowl Competition for Petroleum Engineers all over the world in Qatar 2014, Houston Texas, USA 2015 and Dubai 2016. The dept successfully hosted the Student's STSE Conference and Exhibition 2021, SPE-IUO Chapter won the **2022 SPE International Student Chapter Excellence Award**. Our staff presented paper that won Best Paper Award, while our student won the Drops Award at NAICE 2022. Also took second place in the Kahoot quiz at STSE 2023. All these awards further enhanced our visibility nationally and globally.

1.7.1 General Administration of the Department of Petroleum Engineering

The Department has 10 members of staff. Decision-making is usually collective; taken at the

Departmental Board of study meeting. Committees are constituted comprising of staffs to handle various areas of administrations in the department as shown in Table 1. Staff are given the opportunity to study for higher degree at Full/ Part-time and are promoted after three years if they are productive (research and publication).

Table 1: Some Committees in the Department**.**

S/N	COMMMITTEE	MEMBERS
1.	Examination Committee	Engr. Dr. E. D. Akpobi (chair) Engr. Dr. A. Azuokwu Engr. Dr. Y.Yerima
2	Quality Assurance	Dr E. D. Akpobi Prof P. Akpoturi Dr. Y. Yerima (Chair) Engr. R. Opute
3	Project Coordination Committee	Engr. Dr. A. Azuokwu (Chair) Dr. Y. Yerima Engr. P. Obeta
4	SIWES Coord. Committee	Mr. Ngubi(Chair) Mr Johnson Johnson Engr. R. Opute
5	Staff Dev. & Promotion Committee	Prof R. U. Azike (Chair) Prof S. E. Ogbeide Dr E. D. Akpobi Engr. Dr. Y. Yerima
6	Finance & Fund-Raising Committee	Engr. Dr. A. Azuokwu (Chair) Engr. Dr W.A. Raji
7	Departmental Board	Dr. E. D. Akpobi (Chair) All Departmental Staff Engr. Randolph Deh Opute (Secretary)
8	Seminar Coord. Committee	Dr. Y. Yerima (Chair) Mr. Johnson Johnson O. Engr.Dr. Augustine Azuokwu
9	Lecture Timetable /Monitoring Committee	Engr. R. Opute (Chair) Engr. Dr. W.A. Raji Johnson Johnson
10	Staff & Students Welfare Committee	Dr. E. D. Akpobi Engr. P. Obeta Engr. Dr Y.Yerima
11	Curriculum Committee	Engr. Dr. E. D. Akpobi (chair) Engr. Dr. Augustine Azuokwu Engr. Dr. Yerima
12	Linkages and Collaborations	Prof R. U. Azike (chair)

		Prof P. Akpoturi Engr. P. Obeta Eng. Dr E.D Akpobi
13	Research and Publication Committee	Prof. P. Akpoturi Engr. Y. Yerima Engr. Dr. A. Azuokwu
14	Course Adviser	All Lecturers
15	Accreditation Committee	Engr Dr Akpobi (chair) Prof R. U.Azike Engr. Dr. A. Azuokwu Engr. P. Obeta
16	Student Alumni Committee	Engr Dr. Y. Yerima (chair) Engr P. O. Obeta Engr. Dr. A. Azuokwu Engr. Dr. E. D. Akpobi

1.7.2. Students Welfare:

. Academic grievances are handled by the Head of Department and the appropriate course level adviser. In addition, the university has a guidance and counselling unit for each faculty in addition to Servicom unit for each college. Students are free and encouraged to visit that unit for any problem affecting and challenging their stay and academic pursuit in school. They can also do it anonymously. The Servicom unit addresses with immediate effect matters or challenges raised by the writer (student/staff). Reports of other unethical behaviour and attitudes of students/lecturers are handled by a university disciplinary committee comprising the Dean of student affairs with other constituted members of staff. Students are free to make their reports without any victimization and such reports are subject to investigation and necessary actions taken when proven.

1.7.3 Examination:

Examinations are conducted at the end of each semester to assess the students understanding of the taught courses from a combination of examination results, continuous assessments and grades obtained from laboratory/practical work. The student's status may be determined at the end of Session Examinations. Examination Questions (ten) are set by the course lecturer and the External examiners vet and select six/seven questions to be attempted by students. This is applicable to 100 level - 500 level. Examinations are conducted in large halls with students sitting with a space or two spaces in between as applicable. Questions are marked in line with a prepared marking scheme.

1.7.4. External Examiner System:

External Examinations are used mostly in the final year of the undergraduate programme to assess final year courses and projects, and to certify the overall performance of the graduating students, as well as the quality of facilities and teaching.

1.7.5. Regulations Governing the Conduct of Examinations

Instruction to all candidates/students

i. All students of the University are to read and comply with these Regulations on examinations:

ii. Candidates must wear their **IDENTITY CARDS** on them as a condition to sit and write examinations and also bring along a copy of **ON-LINE REGISTRATION printout.** Names are not allowed on the answer script otherwise the script will be cancelled.

iii. Candidates must attend punctually at the time assigned to their papers and must be ready to be admitted into the examination hall five minutes before the examination is due to start. Candidates shall not be permitted in any circumstances to enter the examination hall more than ten minutes before the time appointed for the commencement of the examination. Candidates arriving more than half an hour after the examination has started shall be admitted only at the discretion of the chief invigilator.

iv. Similarly, save with the special permission of the chief invigilator, candidates may not leave the examination hall during the first and the last half an hour of the examination outside these periods, candidates with the permission of the invigilate or, may leave the room temporarily and then only if accompanied by an attendant.

v. Candidates must bring with them to the examination hall their own ink, pens and pencils and any materials which may be permitted by these regulations but they are not allowed to bring any other books or papers.

vi. **While the examinations is in progress communication between candidates is strictly forbidden, and any candidate fund to be giving or receiving irregular assistance may be required to with draw from the examination and/or penalized after.**

vii. Silence must be observed in the examination hall. The only permissible way of attracting the attention of the invigilator is by the candidate raising his/her hand.

viii. Candidates are not allowed to smoke in the examination hall.

ix. **Candidates are informed that medical attention can be obtained if necessary.**

x. The use of scrap paper is not permitted. All rough work must be done in the answer books and crossed neatly through supplementary answer books even if they contain only rough work. Must be tied inside the main answer book.

xi. Candidates are advised in their own interest to write legibly and to avoid using ink. Answer must be written in English except as otherwise instructed. The answer to each question must be started on a separate sheet of paper.

xii. Before handing in their scripts at the end of the examination, candidates must satisfy themselves that they have inserted at the appropriate places their examination numbers and the numbers of the questions they answered.

xiii. It will be the responsibility of each candidate to hand in his script to the invigilator before he leaves the hall. Except for the question paper and any material, they may have brought with them candidates are not allowed to remove or mutilate any paper or material supplied by the University.

1.7.6. Invigilation of Examinations/Instruction to all Staff

All staff are to note and comply with the following Regulations on conduct of examinations:

1. All staff are to wear their **IDENTITY CARDS** while invigilating examination.
2. The organization of invigilation shall be the responsibility of the Time Table Committee in conjunction with the College Deans and HODs. They shall select suitable examination halls and draw up a list of invigilators from members of staff of each College at least a week before the commencement of examination.
3. There shall be a Chief Invigilator for each examination session comprising a listed number of papers.
4. There shall be in each hall two invigilators for the first fifty candidates or less and one additional invigilator for every 100 candidates or part thereof. There shall be one attendant in each hall, due provision being made for the presence of male and female candidates.
5. All invigilators shall be at the examination with all the examination question papers and answer scripts.
6. For each examination, the Examiners of the respective papers shall be present at the examination for the first thirty minutes to address all matters that may arise and should submit a written situation report on the conduct of the examination to the Chief Invigilator.
7. Student shall not be allowed to bring paper including blotting papers into the examination hall. They should normally enter the examination hall only with pen, ink, pencil, eraser, ruler and other materials such as mathematical instrument which may be allowed in the examination hall.
8. Bags, books, lecture files, and all other students' properties must be left outside the examination hall.
9. Invigilator shall inspect the hall and search all candidates before they are seated for the examination to ensure that no student has on him/her any unauthorized materials.

1.7.7 **Igbinedion University, Okada Exams Registration Form (SAMPLE)**

Igbinedion University, Okada (IUO) Exams Registration Form **(sample)**

Form for entry to university examination: 1^{ST} semester 2022/2023 session

To be completed in four (4) photocopies and returned to the College Officer not later than ....………

Eligibility Requirements

No student shall be admitted to any examination in any course unless the Head of Department Offering the course has certified that the student completed the requirements for the course, Namely: full payment of fees, evidence of on-line registration (where available), 75% Mandatory

Attendance of lectures, and One-Shop (Central) Registration clearance.

1. Name of student (Block Letters):

Surname…………………………Other Names …………………………………..

2. Mat. No:.. 3.Sex:

4. Address during session:...

5. Tel & e-mail: ....

6. Address during vacation:..

7. Name and address of sponsor:..

8. Date of Entry to University: ....

9. Course of study/programme:...

NOTE: Examination to be taken should be confirmed by Head(s) of Department offering the courses in the table below. They are requested to append their signatures to certify that the student has met the requirements as state above

10. Student's signature:.............................. Date:...

11. Name of Head of Department:..............................Signature:................ Date:...............

12. Name of Dean:.. Signature: ....Date:...

Distributed by College Officer to: Student, Head of Department, Dean and Academic Affairs.

1.7.8. Student Course Evaluation Form

There is an established mechanism to enable students to evaluate courses delivered to them at the end of each semester. The filled copies are submitted to the academic planning unit of the university for assessment, recommendation and addressing issues that might have been raised by the students. A **sample** of the student course evaluation form is shown as follows

IGBINEDION UNIVERSITY, OKADA

STUDENT COURSE EVEALUATION FORM **(SAMPLE)**

Dear Student,

It is a global practice in academic settings that students be given opportunity to express their views and make recommendations on their educational activities. Such effort will facilitate improved students-teacher relationship and provide opportunity for the College/Department to correct any areas of deficiency and improve teaching-learning environment. This will in turn improve the quality of teaching-learning activities and the learning outcomes.

You are therefore requested to sincerely complete the form below. Please tick the response that you think is the most appropriate to each statement.

Note: **You are not required to write your name**

S/N	Area of Assessment	Excell	Very	Good	Fair	Poor	Weighted
A	**COURSE PRESENTATION**						
1.	Clearly states the course objectives and						
2.	Covers course content with a schedule						
3.	Discusses mode of assessment with Students						
4.	Presents material in a well-organized way						
5.	Completes syllabus within time						
B	**MODE OF DELIVERY**						
6.	Makes good use of teaching aids						
7.	Is clear and understandable at lectures						
8.	Pace of lecture delivery						
9.	Allows opportunities for asking questions						
10.	Shows thorough knowledge of subject						
11.	Links theory with practical						
12.	Lecturer available for consultation on course-related matters outside classes						
C	**LECTURER'S COMPORTMENT AND CLEANLINESS IN CLASS**						
13.	General appearance of lecturer and Attitude in Class						
14.	Ensures that class is Clean and controls class well						
15.	Punctuality and reliability in attendance						
16.	Reschedules lectures and makes up for lost time						
D	**PEDAGOGY**						
17.	Gives adequate assignments and returns written work on time.						
18.	Makes constructive comments on written Work						
19.	Gives adequate tutorials						
20.	The Course has increased my knowledge of the subject						

1.7.9 Examination Misconducts

Examination misconduct and sanctions are tabulated in table 2. Students are advised to avoid anything that will hinder their academic pursuit in this great institution.

Table 2.0 : Examination misconduct and sanctions

S/N	MISCONDUCT	SANCTION
a.	Bringing in unauthorized materials such as: notes, scraps, electronic aids, etc. into the examination hall.	Rustication for one academic session.
b.	Impersonation: is assuming or taking another person's identity for the purpose of writing an examination of that person. (i) Impersonator is the person who holds himself or herself out as being another person so as to write an examination for that other person. (ii) Impersonatee is a person who procures another person to write an examination for him or her.	(i) If the impersonator is a student of the University expulsion of the student from the University. (ii) If the impersonator is not a student of the University, he or she may be handed over to the Police. (iii) for an impersonatee expulsion from the University
c.	Unauthorized communication during an examination, such as: passing written information in an examination hall, orally receiving information from another person within or outside the examination hall, receiving electronic messages from within or outside an examination hall, etc.	Rustication for one academic session for first offender and expulsion from the University for any such subsequent offence by the same student.
d.	Refusal to submit oneself to physical search by an invigilator of the same sex, such as: (i) failure to present the University identification card; (ii Bursary receipts; (iii) examination form; (iv) unruly behavior at the entrance into the examination hall; etc.	Denial of entrance into the Examination hall or forfeiture of the examination
e.	Unauthorized possession of university examination answer	Rustication for one academic semester.
f.	Smuggling of examination script(s) containing already answered questions into the examination hall or attempting to submit same.	Expulsion from the university
g.	Bringing dangerous weapons into the examination hall, such as: gun, knife, cutlass, axe, dangerous chemicals, corrosive materials, or any other object	Expulsion from the university
h.	Mutilation or replacement of any answer script or paper officially supplied with any other unofficial answer script.	Expulsion from the university.
i.	Forgery or mutilation of university identification card, bursary receipt(s), examination form or any other university examination document.	Expulsion from the university.

Note: A female invigilator is present in every examination hall for the enforcement of physical searches of female students suspected to be armed with illegal materials which aid undue advantage during examination.

1.8. **ACADEMIC ATMOSPHERE**:

Igbinedion University has a serene environment fit and proper for academic activities away from the hustle and bustle of crowded cities. This has contributed immensely to progress made by the students.

(a) The department encourages students to dress in a corporate manner (in line with the Senate Decision) while attending lectures.

b) Students are encouraged to use the library/ICT facilities during the free period.

c) The university has guidance and counselling unit. Students are free and encouraged to visit that unit for any problem affecting and challenging their stay and academic pursuit in school. Level course advisors are also involved in guiding and advising the students on proper direction.

d) Reports of other unethical or unruly behaviour and attitudes, misconduct relating to interpersonal relationships and others by students/lecturers are handled by a university disciplinary committee comprising of the Dean, student affairs with other constituted members of staff. These misconducts and sanctions are outlined in the student code of conduct. Students are free to make their reports without any victimization and such reports are subject to investigation and necessary actions taken when proven.

e) The university monitoring committee, also ensures that lectures are delivered accordingly in line with the lecture timetable.

f) There is also a quality assurance committee for each college chaired by the Vice Chancellors' representative, Dean, HODs, and course advisers for effective and efficient delivery of lectures.

1.8.1 **Duration of Petroleum Engineering Programme.**

The duration of the Petroleum Engineering programme, in conjunction with satisfaction of all other university requirements and regulations for each entry, are summarized in Table 5.8. Generally, the maximum duration of the programme should not exceed 150% of the normal training period for the programme. No student is awarded a degree without attaining the minimum stipulated years of training

Table 3: Duration Period for Petroleum Engineering Programme

Type of Admission	Minimum (years)	Maximum (years)	Degree Qualification
UME	5	7	B. Eng
A LEVEL/Direct Entry	4	6	B. Eng
OND	4	6	B. Eng
HND	3	5	B. Eng

a. An academic session: An academic session consists of two semesters. Each semester normally comprises 15 weeks of teaching and two weeks of examination

b. Definition of Units: Units also called credits units are loads attached to a course. One unit load is equivalent to one hour per week per semester of 15 weeks of lectures or two hours of tutorials or three hours per week of paperwork or laboratory practical per semester of 15 weeks

1.8.2 Registration Procedure and Student Workload

At the beginning of every session all students are expected to register for all their courses for that session using online registration as required by the University ‘s Examinations and Records Unit of the Registry through their student online portal. This must be done not later than two weeks after the resumption of a new academic session, which begins with the first semester. Late registration attracts a fee, which is determined by the university. They must register for a minimum of 18 credits per semester and 36 credits per session. Students are expected to register all outstanding courses first before the student ‘s current level courses. The maximum number of credits for a session must, however, not exceed 48 credits.

1.8.3 Course Categories

For the B.Eng. degree in Petroleum Engineering programme, courses are listed in the following categories:

Core or compulsory or required Courses (C): - These are courses that students must compulsorily take and pass for the award of Bachelor of Engineering in Petroleum Engineering.

Elective Courses (E): These are courses which are chosen by a student according to interests. It may be within or outside the college. A student may graduate without passing the course provided the minimum credit for graduation has been attained.

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

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

1.8.4 Inter Programme Transfer

Programme transfer is only permitted at the beginning of a new academic session. Students who transfer from one programme or the other, into the Petroleum engineering programme based on approved senate reasons are credited with those units passed that are within the curriculum of the Petroleum engineering programme. It is also subject to approval by the senate.

1.8.5 Probation

Probation is a status granted to a student whose academic performance falls below an acceptable standard. A student whose CGPA is < 1.5 or more than 10 outstanding courses (University Senate Decision) at the end of a particular year of study earns a period of probation for one academic session. Such a student may be allowed to register for courses at the next higher level in addition to his/her failed courses and ensure a maximum of 18 credit units per semester is not exceeded. Secondly, the pre-requisite courses for the higher-level courses must have been passed.

1.8.6 Withdrawal:

A student whose CGPA is < 1.5 at the end of a particular period of probation has to withdraw from the programme and transfer to another programme within the university incommensurate with his or her academic ability and capacity’

1.9. ACADEMIC CONTENT:

Existing Curriculum for the Programme/Sub-discipline/Discipline

1.9.1 Admission Requirements:

UTME Entry Mode

In addition to acceptable passes in UTME, the minimum academic requirement is credit level passes in at least five subjects at O’Level in nationally recognised examination including English Language, Mathematics, Physics, Chemistry and other acceptable science subject at not more than two sittings. It is also desirable for candidates to pass Further Mathematics and Technical Drawing at credit level, such candidates shall have added advantage.

A National Diploma certificate from approved universities or colleges of technologies or Polytechnics with a grade not lower than Merit. In addition, the applicant must possess five credits at SSCE/GCE O' level or its equivalent in subjects which includes English Language, Mathematics Chemistry, Physics and any other science subject.

Direct Entry Mode:

i. Two A' level passes in Mathematics, Chemistry and an additional subsidiary subject. Candidates are expected to possess five credits including English Language, Mathematics, Chemistry, Physics and any other science subject. Results at O'level and A' level must be obtained at not more than two sittings.

ii. Holders of OND and HND at minimum of upper credit level are eligible for consideration for admission into 200 and 300 levels respectively.

Inter-University Transfer Mode

Students can transfer into 200-Level courses provided they have the relevant qualifications. Universities are to satisfy themselves that the grades obtained by such candidates are acceptable.

B.Eng. (Petroleum Engineering) - 5 years.
By Direct Entry - 3/4 years.
Course Content Specifications/Syllabus of all courses in the Programme/Sub-Discipline/Discipline are attached.

2.0 REQUIREMENTS FOR GRADUATION

All students who have been found worthy in **character** and **learning** and who have satisfied all university, departmental and college requirements are qualified to be presented for graduation. For the avoidance of doubt these include: payment of all prescribed fees, pass in all prescribed courses, laboratory practical, industrial training (SWEP/SIWES) with minimum earned credit of 129 - 225 depending on the mode of entry. Such a student must have also met the minimum number of years and not exceeded the maximum number of years required for graduation shown in Table 4

Table 4: Minimum and Maximum No. of years required for Graduation

Level of Entry	Minimum number of years Graduate	Maximum number of years Graduate
100	5	7
200	4	6
300	3	5

The class of the Bachelor of Engineering Degree is determined by the final cumulative grade point average earned by the graduating student.

1.11 CUMULATIVE GRADE POINT AVERAGE (CGPA)

The CGPA for each level of course is calculated from a combination of Grade Point (GP) assigned to percentage score obtained in the examination and the credit assigned to that course. The relationship presented in Table 5

Table 5 Approved Scoring and Grading of score, Grade Point (GP) and GPA / CGPA Calculation.

(i) Credit Units	(ii) Percentage Scores	(iii) Letter Grade	(iv) Grade Point (GP) (GP)	(v) Grade Point Average (GPA)	(vi) Cumulative Grade Point Average (CGPA)
Varying according to contact hour assigned to each course per week per semester and according to student's workload	70 – 100	A	5	Derived by multiplying (i) and (iv) and dividing by total credit units	Derived by multiplying (i) and (iv) and dividing by total credits units for course registered till date
	60 – 69	B	4		
	50 – 59	C	3		
	45 – 49	D	2		
	0 – 44	F	0		

Table 6: Calculation of GPA

Courses Attempted (a)	Credits Attempted (b)	% Scores (c)	Letter Grades (d)	Grade Point (e)	Grade point credit weighed (f)	Cumulative grade point average (GPA) (g)
PEE 331	3	70-100	A	5	3x 5 = 15	
PEE321	3	60 – 69	B	4	3 x 4 = 12	
PEE303	2	60 – 69	B	4	2 x 4 = 8	
EMA 301	3	50 – 59	C	3	3 x 3 = 9	46 = 2.42
PEE 341	2	45- 49	D	1	2 x 1 = 2	19
PEE 351	4	0 – 44	F	0	4 x 0 = 0	
Total	19			Total	46	

The CGPA for each level of course is calculated from a combination of the Grade Point (GP) assigned to percentage score obtained in the examination and the credit assigned to that course. The relationship is presented in Table 6, sat for a total of 19 credits, and ended up with a GPA of 2.42 for that level. This mode of computation is done for each level per student. The cumulative grade points average, CGPA on which the classification of a graduating student is based, the ratio of the total cumulative weighted credit to the total registered credit presented in Table 7

Table 7: CGPA for a Graduating Student, Mr. XYZ

Mat No.	Name of Student	Level	Total Reg. Credits	Cumm. Weighted Credits	CGPA
14/0120167/ENG	Mr. XYZ	100	47	117	
		200	46	196	834/225=3.64
		300	48	155	
		400	32	187	
		500	42	229	
			225	834	3.64

The degree classification, according to the CGPA recommended by the NUC as presented in Table 8

indicate that the candidate, Mr. XYZ who finished up with a CGPA of 3.64 has earned a 2nd Class upper Degree.

1.12 ACADEMIC STANDING:

A student is in good academic standing at the end of any session if the CGPA is not less than 1.5 can proceed to the next level otherwise; such a student attains the status of probation and will be advised to repeat all failed courses from the previous session in the new session. If in the next successive two semesters, the CGPA of such student consistently remains below 1.5 then such a student will be advised to withdraw having failed to utilize the probation period to improve on the academic performance. Note that no candidate is allowed to probate on a level more than once.

Table 8 Degree of Classification based on CGPA

Cumulative Grade Point Average (CGPA)	Class of Degree
4.50 - 5.00	First Class
3.50 - 4.49	2nd Class Upper
2.50 - 3.49	2nd Class Lower
1.50 - 2.49	Third Class
< 1.5	Pass

1.13 Course Credits

All courses for the Bachelor of Engineering degree programme are based on the various departments. Most courses taken at the 100 and 200 levels are common to all Departments in the College and are taught college-wide by Departments assigned to teach the courses. All courses are assigned credits. One credit is equivalent to one hour per week per semester of fifteen (15) weeks of lectures or tutorials or three (3) hours per week of laboratory work per semester. All students in the programme should take a minimum load of eighteen (18) credits per semester. A minimum of nine (9) hours per week, (equivalent to three (3) credits), should be spent on laboratory practical. There should also be one hour of tutorial for every four (4) hours of lecture. All exams 100L courses are CBT based except graphic modelling

1.14 Course Coding

All courses are coded according to Department, level and semester. Thus, the Department codes are as follows:

Chemical/Petroleum Engineering - CHE/PEE
Civil Engineering - CVE
Electrical & Computer Engineering - EEE/CPE
Mechanical Engineering - MEE
The level codes are as follows:
100 level-
200 level -
300 level -
400 level -
500 level -
Semester codes are as follows:
First Semester - 1 or any odd number
Second Semester - 2 or any even number -

For example, the full course code for a 300-level course, offered by Petroleum Engineering in the first semester, is of the form: PEE 341 where, 3 represents the level, 4 the number assigned by the Department to track the course, and 1 represents the semester. Should the same course be available in the second semester, the course code would be PEEE342 where the '2' at the end of the figure signifies the second semester. Other general engineering courses are designated for example as ENS (Engineer in Society), and EMA (Engineering mathematics).

1.15 Registration:

At the beginning of every session all students are to register for all their courses for that session using online registration as required by the University's Examinations and Records Unit of the Registry. They must register for a minimum of 18 credits per semester and 36 credits per session. The maximum number of credits for a session must, however, not exceed 48 credits.

1.16. Course Adviser:

Each Head of Department appoints academic staff as course adviser to the students for the different level of study, with the primary responsibility of ensuring that the students register for the courses and credits as is required, and advising them on University regulations as they relate to their studentship.

1.17 Industrial Training:

Engineering education is incomplete without industrial attachment being part of the degree programme. The NUC recommends a minimum duration of 40 weeks (one semester and 3 long vacations) for industrial attachment. The objective of the attachments cannot be overemphasized. It is to expose the students to a live working environment where they can relate theory to practice and enhance their communication and human relation skills. Priority is given to those engineering concerns in which maintenance and workshop practice plays a major role because they offer practical exposure that may be available in the Colleges. From the aforementioned, the following practical training scheme: Igbinedion University Industrial Training Scheme, (IUITS), is carried out by the college:

1. Pre-degree IUITS - IUITS 102

This is an intensive eight-week in house practical training in the various workshops within the College and around the campus. It commences two weeks after the end of the 100 level Session Examinations for 100 level Engineering students. During this period, the students are exposed to workshop practices that may be encountered in the mechanical, machine, sheet metal, automobile, welding, carpentry, civil and electrical engineering workshops.

2. First Industrial Attachment (200 level IUITS) - IUITS 202 (SWEP I)

This takes place in the long vacation after the end of the 200 level session examinations, in relevant industries for a period of 12 weeks, with supervisory visits by College staff.

3. Second Industrial Attachment (300 Level IUITS) - IUITS 302 (SWEP II)

The attachment takes place at the end of the 300 level session examinations for 12 weeks of the long vacation. Again, College staff are expected to visit the trainees for on-the- spot assessment of their progress.

4. Third Industrial Attachment (400 Level IUITS) - IUITS 402 (SWEP III).

The attachment, which begins at the end of the first semester examinations, at the 400 level of the programme, is the final exposure to industrial practice before the completion of the Bachelor of Engineering degree programme. It last for 24 weeks. It is expected that during the training, the student is exposed to his/her chosen Engineering Degree.

5. Grading and Assessment of Industrial Training

This should be a combination of Continuous Assessment (CA) by the supervising college staff that visit the students on training, and the grading of the logbooks and final written reports of each student at the end of each training attachment. The designated officer of the establishment must properly authenticate such logbooks and reports where the students served. Each week of Industrial Training is assigned one (1) credit. Consequently, the totality of Industrial Training amounts to 56 credits. For a student to graduate, such a student must have satisfied 42 IUITS credits and obtained a minimum of 50% in the logbook and final written report.

2.0 B.ENG. ENGINEERING DEGREE PROGRAMME CURRICULUM PETROLEUM ENGINEERING COURSE SCHEDULE

100 LEVEL - FIRST SEMESTER

CORE COURSES: General Chemistry 1 (CHM111), Organic Chemistry (CHM112), Algebra & Trigonometry (MTH111), Calculus/Real analysis (MTH112), Mechanics, Thermal/Physical properties of matter (PHY111), Vibrations, Waves & Optics (PHY112), Use Of English 1(GST111) and Philosophy & Logic (GST112). use of Library, Study Skill and ICT(GST113), IT Essentials (GST 114)

CORE COURSES: **SECOND SEMESTER**

General Chemistry 11(CHM121), General Laboratory Chemistry (CHM122), Organic Chemistry 11 (CHM123), Vector Geometry/Statistics (MTH 121), Differential Equations & Dynamics (MTH122), Practical Physics (PHY100), Electromagnetism & Modern Physics (PHY121), Nigerian people & Culture (GST121), Philosophy & Logic (GST122), Communication in French (GST 123), Contemporary Health Issues (GST 125) and Igbinedion University Industrial Training Scheme (IUITS102)

200 LEVEL - FIRST SEMESTER

CORE COURSES: Engineering Mathematics 1 (EMA201), Computers and Computing (ECP 201) Strength of Materials (MEE231), Engineering Drawing I (MEE 221), Electrical Engineering I (EEE 211), Manufacturing Technology I (MEE271), Engineer-in-Society (ENS211) Lab/Workshop Practice (ELA201), Introduction to Entrepreneurial Skills (EPS223), Thermodynamics I (MEE251), History and Philosophy of science(GST211)

SECOND SEMESTER

CORE COURSES: Introduction to Petroleum Engineering (PEE202), Engineering Mathematics II (EMA202), Applied Engineering Mechanics (MEE212), Material Science (MEE242), Fluid Mechanics I (MEE 262), Electrical Engineering II (EEE212), IT in Engineering (ECP204) Lab/W/shop Practice ELA202, I.U.Industrial Training Scheme (IUITS202), Peace Studies and Conflict Resolution (GST221), Leadership Skills (GST224)

300 LEVEL - FIRST SEMESTER

CORE COURSES: Industrial studies I(303), Petroleum engineering Rock Mechanics (341), Reservoir Engineering I: Rock and Fluid Properties(321), Research methods and Technical

Report Writing (GRE 331). Heat and Mass Transfer (PEE331), Strength of Material and theory of Structure (CVE311), Engineering Mathematics III(EMA 301), Petroleum Laboratory Practice (PEE301), Introduction to Entrepreneurship studies (EPS311)

300 LEVEL **SECOND SEMESTER**

CORE COURSES: Drilling Fluid Technology(332), Industrial Studies II (302), Drilling technology I (342), Petroleum Geology (PEE322) Petroleum Production Engineering I(352) Fluid Transport Phenomena (CHE362), Engineering Mathematics IV (EMA 302), Petroleum Laboratory/Workshop Practice (PEE 302) Igbinedion University Industrial Training Scheme (IUITS 302)

400 LEVEL - **FIRST SEMESTER**

CORE COURSES Engineering Mathematics IV (EMA 401), Reservoir Engineering II(PEE461), Well Testing and Analysis(PEE431), Petroleum production engineering (PEE471), Drilling Technology II(PEE411), Applied Geophysics and Petroleum Exploration (PEE421) Industrial Studies III(PEE403), Well Logging and Interpretation (PEE451), Petroleum Refining Processes (CHE441), Engineering Economics (CHE451), Career Enhancement and resilience training (CERT 411), Petroleum Engineering Laboratory/Workshop Practice (PEE401)

ELECTIVES Computer Applications in Petroleum Engineering (PEE 481)

400 LEVEL **SECOND SEMESTER**

CORE COURSES: Six Months Industrial Training (IUITS 402)

500 LEVEL - **FIRST SEMESTER**

CORE COURSES: Reservoir Engineering III (PEE561), Natural Gas Processing and Engineering(PEE581), Petroleum Refining Processes (PEE551), Engineering Management /Law (GRE 501), Research Project (PEE 501), Petroleum Engineering Laboratory (PEE505) Petroleum Economics: Oil Field Dev. (PEE531), Drilling Technology III (PEE511), Engineering Analysis II: Numerical Method (PEE591)

ELECTIVE Enhanced Recovery Processes (PEE593)

500 LEVEL **SECOND SEMESTER**

CORE COURSES: Engineering Management and Law(GRE502), Industrial Safety and Pollution Control (PEE552), Petroleum Production Engineering III(PEE572), Offshore Technology(PEE594), Petroleum Product Transport and Storage(PEE584), Research Project (PEE502)

ELECTIVES Process technology pee585 , Multiple flow in pipes PEE510

2.1 Programme/Sub-Discipline/Discipline Workload by students in Petroleum Engineering department

Table 1.5: 100 Level First Semester

Course Code	Course Title	Unit	Status	Prerequisite	Contact Hours/Week			Total Week Load
					L	T	P	
CHM111	General Chemistry I	**3**	**Core**		**2**	**1**	**-**	**3**
CHM112	Organic Chemistry I	**2**	**Core**		**2**	**-**	**-**	**2**
MTH111	Algebra & Trigonometry	**3**	**Core**		**2**	**1**	**-**	**3**
MTH112	Calculus/Real Analyses	**3**	**Core**		**2**	**1**	**-**	**3**
PHY111	General Physics I (Mechanical and properties of matter	**2**	**Core**		**2**	**1**	**-**	**3**
PHY112	General Physics II (Fluid Dynamics/Elasticity)	**2**	**Core**		**2**	**-**	**-**	**2**
PHY113	General Physics III (Thermal Physics)	**2**	**Core**		**2**	**-**	**-**	**2**
GST111	Communication in English I	**2**	**Core**		**2**	**-**	**-**	**2**
GST112	Logic, Philosophy and Human Existence	**2**	**Core**		**2**	**-**	**-**	**2**
GST113	Use of library, study skills and ICT	**2**	**Core**		**2**	**-**	**-**	**2**
GST114	IT Essentials	**2**	**Core**		**2**	**-**	**-**	**2**
	1st Semester Total Credit Units	**25**						

Table 1.6: 100 Level Second Semester

Course Code	Course Title	Credit Units	Status	Prerequisite	Contact Hours/Week			Total Week Load
					L	T	P	

CHM121	General Chemistry II	**3**	**Core**		**2**	**1**	**-**	**3**
CHM122	General Chemistry	**2**	**Core**		**-**	**-**	**2**	**2**
CHM123	Organic Chemistry II	**2**	**Core**		**2**	**1**	**-**	**3**
MTH121	Vectors, Geometry/Statistics	**3**	**Core**		**2**	**1**	**-**	**3**
MTH122	Differential Equations & Dynamics	**3**	**Core**		**2**	**1**	**-**	**3**
PHY100	Practical Physics	**1**	**Core**		**-**	**-**	**6**	**6**
PHY121	Electromagnetism & Modern Physics	**2**	**Core**		**3**	**1**	**-**	**4**
PHY122	Modern Physics I	**2**	**Core**		**2**	**-**	**-**	**2**
PHY123	Waves, Vibration & Optics	**2**	**Core**		**2**	**-**	**-**	**2**
GST121	Nigerian Peoples and Culture	**2**	**Core**		**2**	**-**	**-**	**2**
GST122	Communication in English II	**2**	**Core**		**2**	**-**	**-**	**2**
GST125	Contemporary Health Issues	**2**	**Core**		**2**	**-**	**-**	**2**
IUITS102	Igbinedion University Industrial Training Scheme	**1**	**Core**		**-**	**-**	**1**	**1**
	2nd Semester Total Credit Units	**27**						
	Total Sessional Credit Units	**52**						

CHM111 – GENERAL CHEMISTRY I 3 CREDITS

COURSE CONTENT

Relationship of Chemistry to other sciences. Atoms, subatomic particles, Isotopes, Molecules. Avogadro's Number. Mole concept. Dalton's Theory, Modern concepts of atomic theory. The laws of chemical combination. Relative atomic masses. Nuclear binding energy, fission and fusion. The states of matter: Gases: Gas Law. The general gas equation. Liquids and Solids – Introduction to lattice structure, Isomorphism. Giant molecules. Introduction to the Periodic Table. Hydrogen and hydride Chemistry of Groups 0, I, II elements, Acid-Base properties of oxides.

LEARNING OUTCOMES

At the end of this course, the students should be able to:
1. Define atom, molecules and chemical reactions.
2. Discuss the modern electronic theory of atoms.
3. Write electronic configurations of elements on the periodic table.
4. Rationalize the trends of atomic radii, ionization energies, electronegativity of the elements based on their position in the periodic table.
5. Identify and balance oxidation–reduction equation and solve redox titration problems and draw shapes of simple molecules and hybridized orbitals.
7. Identify the characteristics of acids, bases and salts, and solve problems based on their quantitative relationship.
8. Apply the principles of equilibrium to aqueous systems using lechatelier's principle to
Predict the effect of concentration, pressure and temperature changes on equilibrium mixtures.
9. Analyse and perform calculations with the thermodynamic functions, enthalpy, entropy and free energy.
10. Determine rates of reactions and its dependence on concentration, time and temperature.

CHM112: ORGANIC CHEMISTRY I 3 CREDITS

(a) GENERAL PRINCIPLES OF ORGANIC CHEMISTRY:

DESCRIPTION:

(i) Introduction: Definition of Organic Chemistry. Classification of Organic compounds. Homologous series. Functional groups.
(ii) General procedure for isolation of purification of organic compounds.
(iii) Determination of structure of organic compounds. Elemental analysis, percentage composition, empirical and molecular formula, structural formula.
(iv) Isomerism. Structural isomerism and stereo isomerism.
(v) Electronic theory in organic chemistry. Atomic models, quantum numbers, atomic orbital. Hybridization leading to formation of carbon-carbon, single, double and triple bonds. Hydrogen bonding, electronegativity. Dipole moment. Polarization, bond energy. Inductive and resonance effects.

(b) **NON-POLAR FUNCTIONAL GROUP CHEMISTRY:**

DESCRIPTION:

(i) Alkenes: Structure and physical properties. Substitution actions including mechanism.
(ii) Alkenes – Structure and physical properties. Reaction: addition (of H_2, X_2, HX, H_2O, O_3), etc; Oxidation polymerization. Stereo-isomerism – definition, geometrical and optical isomers, conditions for optical isomerism.
(iii) Alkynes, structure. Acidity of acetylenic hydrogen. Reaction: addition of H_2, X_2, HX, H_2, H_2, O, etc. Test for Alkynes.
(iv) Benzene: Structure and aromaticity of benzene. Introduction to electrophilic.
(v) Introduction to petro-chemistry. Origin of petroleum importance, fractional distillation of crude oil, components properties and uses. Octane number, cracking.
(vi) Coal tar chemistry, origin, production, important components and uses.

LEARNING OUTCOMES

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

1. State the importance and development of organic chemistry.
2. Define fullerenes and its applications.
3. Discuss electronic theory.
4. Determine the qualitative and quantitative of structures in organic chemistry.
5. State rules guiding nomenclature and functional group classes of organic chemistry.
6. Determine the rate of reaction to predict mechanisms of reaction.
7. Identify classes of organic functional group with brief description of their chemistry.
8. Discuss comparative chemistry of group Ia, IIa and IVa elements.
9. Describe basic properties of transition metals.

PRACTICAL ORGANIC CHEMISTRY:

DESCRIPTION:

Experiments in basic techniques in organic chemistry: determination of melting points and boiling points, filtration, distillation, fractional distillation, re-crystallization, tests for functional groups: organic preparations.

LEARNING OUTCOMES

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

1. state the general laboratory rules and safety procedures;
2. collect scientific data and correct carry out chemical experiments;
3. identify the basic glassware and equipment in the laboratory;
4. state the differences between primary and secondary standards;
5. perform redox titration;
6. record observations and measurements in the laboratory notebooks; and
7. analyse the data to arrive at scientific conclusions.

MTH111 – ALGEBRA AND TRIGONOMETRY 3 CREDITS

COURSE CONTENT

Real number system: simple definition of integers, rational and irrational numbers. The principle of mathematical induction. Real sequences and series; elementary notions of convergence of geometric, arithmetic and other simple series. Theory of quadratic equations. Simple inequalities: absolute value and the triangle inequality. Identities: partial fractions.

Sets and Subsets, union, intersection, complements, properties of some binary operations of sets; distributive, closure, associative, cumulative laws with examples, relations in a set; equivalence relation. Properties of set functions and inverse set functions, permutations and combinations.

Binomial theorem for integer n – o index: Circular measure, trigonometric functions of angles of any magnitude. Addition and factor formulae. Complex numbers; algebra of complex numbers, the Argand diagram, De Moivre's theorem, n-throat of unity.

LEARNING OUTCOMES

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

1. Define and explain set, subset, union, intersection, complements, and demonstrate the use of Venn diagrams.
2. Solve quadratic equations.
3. Solve trigonometric functions.
4. Identify various types of numbers.
5. Solve some problems using binomial theorem.

MTH112: CALCULUS/REAL ANALYSES - 3 CREDITS

COURSE CONTENT:

Elementary functions of a single real variable and their graphs, limits and the idea of continuity. Graphs of simple functions; polynomial, rational, trigonometric, etc., rate of change tangent and normal to a curve. Differentiation: as limit of rate of change of elementary functions, product quotient, function of function rules. Implicit differentiation of exponential functions. Logarithmic and parametric differentiation. Use of binomial expansion for any index. Stationary values of simple functions: maxima, minima and points of in-flexion, integration by substitution and by parts. Definite integral: Volume of revolution, area of surface of evolution.

LEARNING OUTCOMES

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

1. Identify the types of rules in differentiation and integration.
2. Recognize and understand the meaning of function of a real variable, graphs, limits and continuity.
3. Solve some applications of definite integrals in areas and volumes.
4. Solve function of a real variable, plot relevant graphs, identify limits and idea of continuity.
5. Identify the derivative as limit of rate of change.
6. Identify techniques of differentiation and perform extreme curve sketching.
7. Identify integration as an inverse of differentiation.
8. Identify methods of integration and definite integrals.
9. Perform integration application to areas, volumes.

PHY111: MECHANICS, THERMAL/PHYSICAL PROPERTIES OF MATTERS - 3 CREDITS

COURSE CONTENT:

Mechanics: Scalars and Vectors: Addition and resolution of vectors. Rectilinear motion and Newton's law of motion. Inertial mass and gravitational mass; free fall; projectile motion; deflecting forces and circular motion. Newton's law of gravitation; satellites, escape velocity. Gravitational potential, potential; potential well; special case of circular motion.

Momentum and the conservation of a momentum. Work, power energy; units. Potential energy for a gravitational field and elastic bodies; kinetic energy conservation of energy; energy stored in a rotating body. Kinetic energy in elastic and inelastic collisions.

LEARNING OUTCOMES

On completion, the students should be able to:

1. Identify and deduce the physical quantities and their units.
2. Differentiate between vectors and scalars.
3. Describe and evaluate motion of systems on the basis of the fundamental laws of mechanics.
4. Apply newton's laws to describe and solve simple problems of motion.
5. Evaluate work, energy, velocity, momentum, acceleration, and torque of moving or rotating objects.
6. Explain and apply the principles of conservation of energy, linear and angular momentum.
7. Describe the laws governing motion under gravity.
8. Explain motion under gravity and quantitatively determine behaviour of objects moving under gravity.

PHY 113: THERMAL & PHYSICAL PROPERTIES OF MATTER:

COURSE CONTENT

Temperature, heat, work; heat capacities; second law, Carnot cycle; thermodynamic ideal gas temperature scale. Thermal conductivity; radiation; black body and energy spectrum, Stefan's law. Kinetic model of a gas: equation of state, concept of diffusion, mean free path, molecular speeds, Avogadro's number, behaviour of real gases. A model for a solid: inter-particle forces in solids, liquids and gases; physical properties of solids. Crystalline structure: Close packing, orderly arrangements, elastic deformation of an ordered structure; interference patterns and crystals. Model for Matter: Surface energy and surface tension, plastic deformation; thermal and electrical properties of metals.

LEARNING OUTCOMES

On completion, the students should be able to:

1. Explain the concepts of heat and temperature and relate the temperature scales.
2. Define, derive and apply the fundamental thermodynamic relations to thermal systems.
3. Describe and explain the first and second laws of thermodynamics, and the concept of entropy.
4. State the assumptions of the kinetic theory and apply techniques of describing macroscopic behaviour.
5. Deduce the formalism of thermodynamics and apply it to simple systems in thermal equilibrium.
6. Describe and determine the effect of forces and deformation of materials and surfaces.

GST111: COMMUNICATION IN ENGLISH I 2 CREDITS

COURSE CONTENT:

The course will consolidate the fundamentals of English Language including the following: Nouns and Pronouns (types and features), Verbs and Tense (varieties), Adjectives and Adverbs (varieties, features and functions), Conjunctions, Prepositions, Interjections, Clauses (types) and Sentences (types). Language skills of listening, speaking, reading and writing (choosing topics for writing, planning, assembling and organizing points, outline preparation, factors of unity, coherence, context, originality, mechanical accuracy and paragraph development). Forms of writing including narrative, descriptive, expository, argumentative, summary, correspondences and speech writing. Use of library including cataloguing systems, locating books/journals, lending/borrowing reference materials, indexing.

LEARNING OUTCOMES

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

1. Identify possible sound patterns in English language.
2. List notable language skills.
3. Classify word formation processes.
4. Construct simple and fairly complex sentences in English.
5. Apply logical and critical reasoning skills for meaningful presentations.
6. Demonstrate an appreciable level of the art of public speaking and listening.
7. Write simple and technical reports.

GST112: NIGERIAN HISTORY AND CULTURE 2 CREDITS

COURSE CONTENT:

A study of Nigerian history and culture from precolonial times, including the Nigerian's perception of his world; culture areas of Nigeria and their characteristics; evolution of Nigeria as a political entity; concept of functional education; national economy; balance of trade; economic self-reliance; social justice; individual and national development; norms and values; environmental sanitation; principles of good and bad, right and wrong; moral implications of our choices; judgments and actions; morality versus expediency; the role of conscience; moral obligations of citizens.

LEARNING OUTCOMES

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

1. Analyze the historical foundation of Nigerian cultures and arts in precolonial times.
2. Identify and list the major linguistic groups in Nigeria.
3. Explain the gradual evolution of Nigeria as a political entity.
4. Analyze the concepts of trade and economic self-reliance of Nigerian peoples in relation to national development.
5. Enumerate the challenges of the Nigerian state regarding nation building.
6. Analyze the role of the judiciary in upholding fundamental human rights.
7. Identify the acceptable norms and values of the major ethnic groups in Nigeria.
8. List possible solutions to identifiable Nigerian environmental, moral and value problems.

GST 113: USE OF LIBRARY, STUDY SKILLS AND ICT - 2 CREDITS COURSE CONTENT:

Brief history of libraries, library and education, University libraries and other types of libraries, study skills (reference services). Types of library materials, using library resources including e-learning, e-materials; etc. Understanding library catalogue (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, software technology, input devices, storage devices, output devices, communication and internet services, word processing skills (typing, etc.).

LEARNING OUTCOMES

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

1. Understand the concepts of library resources and services.
2. Identify and use the various study skills necessary for locating, evaluating and sorting library information resources and services.
3. Understand library OPAC and searching techniques.
4. Understand internet and virtual services.
5. Identify possible hardware and software technologies used in storage, inputting and out putting data.

GST 114: IT ESSENTIALS (2 CREDITS)

COURSE CONTENT:

Introduction to personal computer hardware, PC assembly, Advanced computer hardware, preventive maintenance and Troubleshooting , Networking concepts, Applied networking , Laptops and other mobile devices, printers, virtualization and cloud computing, Windows installation, windows configuration, mobile, Linux and OSX Operating Systems Security. The IT Professional

LEARNING OUTCOMES

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

1. Assemble personal computers and identify computer hardware.
2. Understand the concept of networking virtualization and cloud computing in computers and other IT devices.
3. Understand the significance of security in computer operating systems.
4. Analyze the role of IT Professionals.
5. Install and configure operating systems such as Windows, Linux and OSX.

CHM121: GENERAL CHEMISTRY II 3 CREDITS

COURSE CONTENT:

Acids, Bases and Salts. Quantitative analysis. Theory of volumetric analysis – operations and methods. Calculations: mole, molality, molarity. Behaviour of electrolytes. Water. Colligative properties. Ostwald's dilution law. Arrhenius, Bronsted-Lowery, Lewis concepts and applications. Buffers. Introduction to reaction rates. Equilibria and equilibrium constants. Solubility products. Common ion effects. Precipitation reactions.

CHM123: ORGANIC CHEMISTRY II 3 CREDITS

(a) POLAR FUNCTIONAL GROUP CHEMISTRY:

COURSE CONTENT:

(i) Hydroxyll group – Alcohol and phenols. Classification. Acidity-comparison. Important methods of preparation. Reactions: with metals, bases, alky halides. Oxidation, dehydration. Tests for alcohols and phenols, importance.

(ii) Carbonyl group – Aldehydes and ketones structure: Physical properties. Important methods of preparation. Reactions: Tollen's reagent, Fehling's solution, benedict's solution, Lodoform reaction;

with HCN, $HaHSO_3$; alcohols, including mechanisms, with ammonia, hydra-zines and their derivatives, including mechanisms; aldol condensation. Tests for aldehydes and ketones. Importance.

(iii) Carboxylic group: Mono-carboxylic acids. Structure. Physical properties. Acidity and resonance. Important methods of preparation, from alcohols, aromatic hydrocarbons, through Grignard's reagent. Reaction with bases. Conversion to esters, amides, halides and anhydrides. Tests for carboxylic acid. Importance.

(iv) Carboxylic acid derivatives: Anhydrides acid halides esters and amides. Change of reactivity when OH of acid is replaced by – OOCOR-X –OR, -NR. Reaction with water, alcohols, ammonia and amines. $LIACH_4$, Test for esters.

(v) Amino group – Amines. Structure, Physical properties. Important methods of preparation. Reaction with acids, basicity and salt formation; Alkylation, acylation, with nitrous acids. Heisenberg method of separation. Tests for amines, importance.

(b) MISCELLANEOUS TOPICS:

COURSE CONTENT:

i. Fats and Oils: Definition, importance, Saponification, Soaps and detergents. Modes of cleaning action. Reaction of soap with hard water, mineral acids. Drying oils, mode of action, use in paints and varnishes.
ii. Amino acids, Proteins: Definition, classification, essential amino acids, special properties and reactions, iso-electric point, tests, importance.
iii. Carbohydrates: Definition, classification, importance, nomenclature, structure and reactions of glucose.
iv. Natural Products: Main classes (other than lipids carbohydrates and proteins); Steroids, terpenoids, alkaloids, prostaglandins definition, importance, examples.

MTH121: VECTORS, GEOMETRY AND STATISTICS: 3 CREDITS

COURSE CONTENT:

(a) Vector and Coordinate: Types of vectors; points, line and relative vectors. Geometrical representation of vectors in 1 – 3 dimensions. Addition and vectors and multiplication by scalar; Components of vectors in 1, 3 dimensions; direction cosines. Linear independence of vectors. Point of division of a line. Scalar and vector products of two vectors. Simple applications. Two-dimensional coordinates geometry; straight lines, angle between two lines, distance between points. Equation of circle, tangent and normal to a circle. Properties of parabola, ellipse, hyperbola. Straight lines and planes in space, direction cosines; angle between line and between lines and planes; distance of a point from a plane; distance between two skew lines.

(b) Statistics: Introduction of statistics. Diagrammatic representation of descriptive data. Measures of location and dispersion for ungrouped data. Grouped distribution measures of location and dispersion for grouped data. Problems of grouping. Associated graphs. Introduction to probability: sample space and events, addition law, use of permutation and combination in evaluating probability. Binomial distribution. Linear correlation; scatter diagram, product-moment and rank correlation. Linear regression.

LEARNING OUTCOMES

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

1. Solve some vectors in addition and multiplication.
2. Calculate force and momentum.
3. Solve differentiation and integration of vectors.

MTH122: DIFFERENTIAL EQUATIONS AND DYNAMICS - 3 CREDITS

COURSE CONTENT:

(a) Differential Equations: Formation of differential equation of 1^{st} degree and 1^{st} order. Variables, separable, exact, homogeneous and linear, differential equations of the 2^{nd} order with constant coefficients.

(b) Dynamics: Resume of simple kinematics of a particle. Differentiation and integration of vectors with respect to a scalar variable. Application to radial and transverse, normal and tangential, components of velocity and acceleration of a particle moving in a plane. Force, momentum and laws of motion; law of conservation of linear momentum. Motion under gravity, projectile. Simple cases of resisted vertical motion. Motion in a circle (horizontal and vertical). Law of conservation of angular momentum. Applications of the law of conservation of energy. Work, power and energy. Description of Simple Harmonic Motion (SHM). SHM of a particle attached to an elastic string or spring. The simple pendulum. Impulse and change in momentum. Direct impact of two smooth spheres, and of a sphere on a smooth plane.

(c) Rigid body motion: Moments of inertia, parallel and perpendicular axes theorems. Motion of a rigid body in plane with one point fixed, the compound pendulum. Reactions at the pivot. Pure rolling motion of a rigid body along a straight line.

LEARNING OUTCOMES

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

1. Calculate force and momentum.
2. Solve differentiation and integration of vectors.

PHY100: Practical Physics 2 Credits

COURSE CONTENT:

Students are expected to carry out a minimum of 12 major experiments covering the main aspects of the courses taken in the year. per-requisites: 0-Level or WASC.

LEARNING OUTCOMES

On completion, the student should be able to:

1. Conduct measurements of some physical quantities.
2. Make observations of events, collect and tabulate data.

3. Identify and evaluate some common experimental errors.
4. Plot and analyse graphs.
5. Draw conclusions from numerical and graphical analysis of data.
6. Prepare and present practical reports.

PHY121: ELECTROMAGNETISM AND MODERN PHYSICS

(a) **ELECTROMAGNETISM** **3 CREDITS**

COURSE CONTENT:

Electric field: Strength, flux and the inverse square law; electrostatic force between two charged particles; flux model for the electric field. Energy stored in an electric field, electrical potential due to dipole. Steady direct currents: Simple circuits; potential difference resistance, power, electromotive force, Kirchhoff laws; potential divider, slide-wire potentiometer, bridge circuits, combining resistances. Capacitors: Capacitance, combination of dielectrics, energy stored, charging/discharging. Electromagnetic effects; electromagnetic forces, electric motors, moving coil galvanometer, ammeter, voltmeter, electromagnetic induction, dynamo.

Alternating currents: Simple A.C. circuits, transformers, motors and alternating currents.

Magnetic field: The field at the centre of a current-carrying flat coil of a current carrying solenoid, outside a long solenoid, flux model and magnetic fields. Electromagnetic induction: Induction in a magnetic field; magnitude and direction of induced e.m.f; energy stored in a magnetic field; self-inductance. Electricity and matter: Current flow in an electrolyte, Millikan experiment; conduction of electricity through passes at low pressure, cathode rays; photo-electricity.

LEARNING OUTCOMES

On completion of the course, students should be able to:
1. Describe the electric field and potential, and related concepts, for stationary charges.
2. Calculate electrostatic properties of simple charge distributions using coulomb's law, Gauss's law, and electric potential.
3. Describe and determine the magnetic field for steady and moving charges.
4. Determine the magnetic properties of simple current distributions using biot-savart and ampere's law.
5. Describe electromagnetic induction and related concepts and make calculations using Faraday and lenz's laws.
6. Explain the basic physical of maxwell's equations in integral form.
7. Evaluate dc circuits to determine the electrical parameters.
8. Determine the characteristics of ac voltages and currents in resistors, capacitors, and inductors.

PHY 122: MODERN PHYSICS 1 CREDIT

COURSE CONTENT:

Structure of atom: Atomic theory, X-rays, Planck Quantum theory; Wave-particle nature of matter: scattering experiment of Geiger and Marsuen, Rutherford atom model, Bohr's atom model. Structure

of nucleus: Composition of nucleus, artificial transmutation of an element, natural transmutation of an element; discovery of neutron, particle, emission, isotopes, and gamma radiation.
Prerequisite: O-Level or WASC.

LEARNING OUTCOMES

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

1. Relate the atomic structure and energy associated with the particles of the atom.
2. Apply the ideas of wave-particle duality and the uncertainty principle to solve problems in quantum mechanics.
3. Apply the Bohr formula to calculate energies and wavelengths in the context of atomic hydrogen.
4. Explain the interaction of photons and electrons with matter.

PHY123: VIBRATIONS, WAVES AND OPTICS: 3 CREDITS

COURSE CONTENT:

Periodic motion of an oscillator: Velocity and acceleration of a sinusoidal oscillator, equation of motion of a simple harmonic oscillator: damped oscillations; forced oscillations; resonance; propagation of longitudinal and transverse vibrations. Wave and light: Mirrors, formation of images, thin lenses in contact, microscope, telescope; chromatic and spherical aberrations and their reduction, Dispersion by prisms; relations between colour and wavelength; spectra.

LEARNING OUTCOMES

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

1. Explain the purpose and use of mathematical tools relating to waves and optics.
2. Account the difference between wave equation of motion and the Newtonian mechanics.
3. Discuss the working principle of optical system.
4. Design optical instruments.

GST121: NIGERIAN PEOPLES AND CULTURE (2 CREDITS)

COURSE CONTENT:

A brief history of libraries, Library and education. University library and other types of libraries. Study skills (reference services). Types of library material. Using library resources including e-learning, e-materials, etc. Understanding library catalogue (card, OPAC etc), and classification, copyright and its implications. Data base 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).

LEARNING OUTCOMES

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

1. Analyse the historical foundation of Nigerian cultures and arts in precolonial times.
2. Identify and list the major linguistic groups in Nigeria.
3. Explain the gradual evolution of Nigeria as a political entity.

4. Analyse the concepts of trade and economic self-reliance of Nigerian peoples in relation to national development.
5. Enumerate the challenges of the Nigerian state regarding nation building.
6. Analyse the role of the judiciary in upholding fundamental human rights.
7. Identify the acceptable norms and values of the major ethnic groups in Nigeria.
8. list possible solutions to identifiable Nigerian environmental, moral and value problems.

GST122: COMMUNICATION IN ENGLISH II (2 CREDITS)

COURSE CONTENT:

Logical presentation of papers. Phonetics, instruction on lexis, art of public speaking and oral communication. Figures of speech. Précis, Report writing.

LEARNING OUTCOMES

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

1. Identification and utilization of various parts of speech
2. Deliver an effective public speech.
3. Write various forms of essays, Précis and reports.
4. Understand the system of sound and oral communication.

GST123: COMMUNICATION IN FRENCH (2 CREDITS)

COURSE CONTENT:

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

LEARNING OUTCOMES

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

1. Understand and produce simple texts in French.
2. Effectively communicate in oral and written French.
3. Analyse simple French sentence construction.

GST 125: CONTEMPORARY HEALTH ISSUES (2 CREDITS)

COURSE CONTENT:

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

LEARNING OUTCOMES

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

1. Examine the various levels of health promotion/ disease prevention.
2. Identify and compare the major classifications of drugs.
3. Assess human behaviour choices, apply that information to everyday life for the improvement of individual, family, and community well-being.
4. Identify preconceived ideas about knowledge, values and behaviour that affect health and compare with established research and accepted scientific evidence.

IUITS 102: IGBINEDION UNIVERSITY INDUSTRIAL TRAINING SCHEME 1 (1 CREDIT)

COURSE CONTENT:

A 6-week intensive training program within the university. Introductory lectures on engineering; Exposure and visits to engineering project sites both within the university; neighbourhood; and visit to engineering based establishments. And Intensive industrial training in the university engineering workshops, etc. Students submit and defend reports at the end of the exercise. They also write examination.

LEARNING OUTCOME

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

1. Explain at least eight (8) disciplines in engineering and their relevance.
2. Identify eight (8) laboratories within the college and State at least eight (8) workshop tools, equipment, machines ,their functions
3. Conduct practical production of simple domestic tools in groups such as chairs, hoes. etc.
4. Sketch neatly at least ten (10) engineering symbols and signs, safety measures and skills used in firefighting.
5. Discuss overview of various engineering departments in the college

TABLE 2: WORKLOAD FOR 200L STUDENTS OF PETROLEUM ENGINEERING DEPARTMENT

Course Code	Course Title	Unit	Status	Prerequisite	Contact Hours /Week			Total Week Load
					L	T	P	
MEE 221	Engineering Drawing,	2	**Core**		1	-	2	3

MEE 231	Strength of Materials	2	**Core**		1	1	-	2
MEE 251	Thermodynamics	2	**Core**		1	1	-	2
MEE 271	Manufacturing Technology	2	**Core**		1	-	1	2
ELA 201	Engineering Laboratory / Workshop Practice I	3	**Core**		-	-	9	9
EMA 201	Engineering Mathematics I	3	**Core**		2	1	-	3
ECP 201	Computers and Computing	2	**Core**		2	1	-	3
EEE 211	Electrical Engineering, I	2	**Core**		2	1	-	3
ENS 211	Engineer in Society	1	**Core**		1	1	-	2
GST 211	History and Philosophy of Science	2	**Core**		1	1	-	2
	1st Semester Total Credit Units	**21**						

200 Level Second Semester Workloads of Students

Course Code	**Course Title**	**Credit Units**	**Status**	**Prerequisite**	**Contact Hours/ Week**			**Total Week loads**
					L	**T**	**P**	
PEE 202	Introduction to Petroleum Engineering	2	**Core**		1	1	-	2
MEE 212	Applied Mechanics	2	**Core**		1	1	-	2
MEE 242	Material Science	2	**Core**		1	1	-	2

MEE 262	Fluid Mechanics	2	**Core**		1	1	-	2
ELA 202	Engineering Laboratory/Workshop Practice II	3	**Core**		-	-	9	9
EEE 212	Electrical Engineering II	2	**Core**		1	1	-	2
EMA 202	Engineering Mathematics II	3	**Core**		2	1	-	3
EPS221	Introduction to Entrepreneurial Skills	2	**Core**		1	1	-	2
ECP 202	IT in Engineering	2	**Core**		1	-	3	4
GST 221	Peace Studies and Conflict Resolution	2	**Core**		1	1	-	2
GST224	Leadership Skills	2	**Core**		1	1		2
IUITS 202	Igbinedion University Industrial Training Scheme.	1	**Core**		-	-	-	1
	2nd Semester Total Credit Units	**25**						
	Total Sessional Credit Units	**48**						

FIRST SEMESTER

EMA201: ENGINEERING MATHEMATICS I 3 CREDITS

COURSE CONTENT:

(a) Complex Analysis: Roots of a complex number. Addition formulae for any number of angles. To express sine in series or cosines of multiple angles. Exponential function of a complex variable. Circular functions of complex variable. Hyperbolic functions. Real and imaginary parts of circular and hyperbolic functions. Logarithmic functions of a complex variable. Real numbers; sequence and series; their convergence and divergence.

(b) Vector: Force, moment and angular velocity. Vector differentiation and integration.

(c) Linear Algebra: Linear spaces, algebra of determinants and matrices.

(d) Calculus: Differentiations and applications. The mean value theorem and its applications. Extension of mean value theorem. Taylor and Maclaurin formulae, Leibnitz's theorem. (Application to the solution of differential equations with variable coefficients), de L'Hospital's. Partial derivatives of functions of two and more variables.

(e) Further Integrations: Reduction formulae

LEARNING OUTCOMES

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

1. Solve qualitative problems based on vector and matrix analyses such as linear independence and dependence of vectors, rank etc.
2. Describe the concepts and calculate problems on limit theory and nth order differential equations
3. Solve the problems of differentiation of functions of two variables and maximization and minimization of functions of several variables.
4. Analyse the applications of double and triple integration in finding the area and volume of engineering solids, and explain the qualitative applications of gauss, stoke's and green's Theorem.
5. Explain ordinary differential equations and applications, partial differential equations and Fourier series,

MEE221: ENGINEERING DRAWING I (2 CREDITS)

COURSE CONTENT:

Introduction. Geometrical constructions. Principles of tangency, construction of slopes. Tapers and Gradients. Fundamentals of descriptive geometry and projection drawing. Central, parallel. Axonometric and Orthographic Projections. Projections of points, lines, plane figures and simple objects. True lengths. Orthographic projections of simple geometrical solids. Cylinder, Cone, pyramid, Prism, Sphere, Hemisphere. Topus I and II, Ring. Drawing of three orthographic projections in first angle from the isometric views of a detail. Non-circular curves. Construction of an ellipse, parabola, hyperbola, Sinusoid, spiral of Archimedes, in-volute, cycloid, epicycloids, hypocycloid. Electronic draughting.

LEARNING OUTCOMES

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

1. Understand the principle of projection and sectioning.
2. Carry out practical on technical standards and procedures for construction of geometric figures.
3. Produce three dimensional and pictorial drawings.
4. Analyse and geometrically construct plane and simple objects using various principles.

MEE231: STRENGTH OF MATERIALS (2 CREDITS)

COURSE CONTENT:

Force systems composition and resolution of forces, moment, couple, resultants of coplanar and three-dimensional force systems, graphical methods in statics. Mechanical isolation of bodies, free body diagrams, conditions for equilibrium of coplanar and three-dimensional force systems.

Elasticity: concept of uni-axial stress and strain. Typical stress-strain curve in tensile testing, Hooke's law, Modulus of Elasticity, proportional limit, elastic limit, yield point, ultimate strength, etc. Safe working stress, factor of safety.

Stress and Strain in axially loaded bar, in bars of varying cross-section and in a bar due to its own weight. Poison's ratio. Shear stress and strain. Complementary shear stress. Strain energy in simple tensile and shear stress. Composite bars. Temperature stresses.

Pre-stressing, stresses due to misfits, loop and axial stresses in pressure vessels. Stresses in thin rotating rings, stresses in rotating rods. Bending of Beams: Calculation of reactions in statically determinate beams. Shearing force and bending moment diagrams. Relationship between load, shear force and bending moment. Theory of bending, second moment of area, bending stresses in beams.

Torsion: Elastic torsion of circular shafts, shafts of varying diameter, shafts with varying torque, compound shafts.

LEARNING OUTCOMES

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

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

MEE 251: THERMODYNAMICS I (2 CREDITS)

COURSE CONTENT:

Systems, stages, property, interactions, equilibrium, cycle, point and path functions temperature, etc. Thermodynamic Properties of Pure Substances: Perfect gas, specific and latent heats, equations of state. Phases of pore substances – solids, liquids and gases. Phase equilibria and changes critical point, properties of vapors, use of thermodynamic tables.

Heat and Work Transfers first law of thermodynamics, general energy equation and Bernoulli's equation. Engine cycles, air-standard cycle, Otto-cycle, simple gas turbine cycle, Carnot cycle, heat pump, etc. Second law of thermodynamics, entropy irreversibility.

LEARNING OUTCOMES

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

1. Calculate absolute and gauge pressure, and absolute temperature, calculate changes in kinetic, potential, enthalpy and internal energy.

2. Evaluate the properties of pure substances such as compressed liquid, saturated liquid-vapor mixture and superheated vapor using property diagrams and tables; arrange the ideal and real gas equations of state.

3.. Formulate the first law of thermodynamics for open and closed system, construct and derive conservation of mass and energy equations.

4. Distinguish heat transfer by conduction, convection and radiation, and calculate the amount of heat energy transferred.

5. Calculate thermal efficiency and coefficient of performance for heat engine, refrigerators and heat pumps. and perpetual-motion machines, reversible and irreversible processes.

MEE271: MANUFACTURING TECHNOLOGY I 2 Credits

Elementary introduction to types and organization of engineering workshops, covering jobbing, batch, mass production. Engineering materials, their uses and properties. Safety in Workshops and general principles of working. Bench work and fittings: hand tools, instruments.

Carpentry: Hand-tools, materials, types of joints and fastenings: Bolt, rivet, welding, brazing, soldering, measurement and marking; for uniformity, circularity, concentricity, etc. Standard measuring tools used in workshops: welding, brazing and soldering: principle, classification, power source.

LEARNING OUTCOMES

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

1. Identify the types and organization of engineering workshops, manufacturing processes and state their uses

2. Describe the common machines and tools, operations and capabilities of machines used in manufacturing process.

3 Recognize engineering materials, their types, uses and properties, metal cutting techniques applied to hand tool and single point tool geometry and cutting fluid.

4. Recognize safety rules and regulations in the workshop and state their obligations in ensuring safety.

5. Explain parts of lathe accessories and attachments, drilling machines, drill bits and their uses.

ECP 201: COMPUTERS AND COMPUTING 2 CREDITS

Program design using pseudo-code/ Flowchart extensive examples and exercises in solving engineering problems. Computer programming using structure basic such as QBASIC symbols, keywords, identifiers, data types, operators, statements, flow of control, arrays, functions and procedures. Extensive examples in solving engineering problems using QBASIC. Use of Visual Programming such as visual Basic in solving Engineering problems.

LEARNING OUTCOMES

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

1. Describe and apply computing, software engineering knowledge, best practices, and standards appropriate for complex engineering software systems.

2. Develop competence in designing, evaluating, and adapting software processes and software development tools to meet the needs of an advanced development project through practical object-oriented programming exposure taught in concrete terms with a specific modern language – preferable selected from python, java or c++.

3. Use widely available libraries to prepare them for machine learning, graphics and design simulations.

4. Develop skills in eliciting user needs and designing an effective software solution.

5. Recognize human, security, social, and entrepreneurial issues and responsibilities relevant to engineering software and the digitization of services.

EEE211: ELECTRICAL ENGINEERING I 2 CREDITS

COURSE CONTENT:

Units. Basic circuit elements and their behaviour in DC circuits. Basic circuit laws and theorems. Introduction to A.C. circuit. Resonance, power and power factor. 3-phase circuits. Basic distribution system. Electrical Measurement: Voltmeters, Ammeters, Ohmmeters, Watt-meters, Energy meters, Measurement of three phase power.

LEARNING OUTCOMES

Students will be able to:

1. Discuss the fundamental concepts of electricity and electrical d.c. Circuits.
2. State, explain and apply the basic d.c. Circuit theorems.
3. Explain the basic a.c. Circuit theory.
4. Apply to solution of simple circuits.

ENS211: ENGINEER IN SOCIETY 1 CREDIT

COURSE CONTENT:

Philosophy of Science, History of Engineering and Technology, Safety in Engineering and Introduction to risk analysis, the role of Engineers in nation building. Invited lectures from professionals.

LEARNING OUTCOMES

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

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

GST 211: HISTORY AND PHILOSOPHY OF SCIENCE (2 CREDITS)

COURSE CONTENT:

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 chemicals, plastics, textiles waste and other materials, Chemical and radio-chemical hazards. Introduction to the various areas of science and technology. Elements of environmental studies.

LEARNING OUTCOMES

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

1. Analyse accurately the nature of science.
2. Explain the nature of man and his environment.
3. Discuss renewable and non-renewable resources
4. Discuss some of the known scientific theories and methodologies.
5. Analyse the environmental effects and hazards of chemicals.

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ELA 201: LABORATORY/WORKSHOP PRACTICE 3 CREDITS

COURSE CONTENT:

The course comprises general, mechanical and electrical components: supervised hands-on experience in safe usage of tools and machines for selected tasks; Use of measuring instruments (callipers, micrometres, gauges, sine bar, wood planners, saws, sanders, and pattern making). Machine shop: lathe work shaping, milling, grinding, reaming, metal spinning. Hand tools, gas and arc welding, cutting, brazing and soldering. Foundry practice. Industrial safety and accident prevention, ergonomics, metrology. Casting processes. Metal forming processes: hot-working and cold-working processes (forging, press tool work, spinning, etc.). Metal joining processes (welding, brazing and soldering). Heat treatment. Material removal processes. machine tools and classification. Simple theory of metal cutting. Tool action and cutting forces. Introduction to CNC machines.

Supervised identification, use and care of various electrical and electronic components such as resistors, inductors, capacitors, diodes and transistors. Exposure to different electric circuits, wiring schemes, analogue and digital electrical and electronic measurements. Household and industrial energy consumption measurements. Practical energy conservation principles.

LEARNING OUTCOMES

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

1. Identify various basic hands and machine tools, analogue and digital measurement devices and instruments, and acquire skills in their effective use and maintenance.
2. Practically apply basic engineering technologies, including metrology, casting, metal forming and joining, materials removal, machine tooling (classification, cutting tool action, cutting forces, non-cutting production) and CNC machining technology.
3. Master workshop and industrial safety practices, accident prevention and ergonomics;
4. physically Recognize different electrical & electronic components like resistances, inductances, capacitances, diodes, transistors and their ratings.

5. Connect electric circuits, understand different wiring schemes, and check ratings of common household electrical appliances, maintenance, practical energy conservation measures.

SECOND SEMESTER

PEE 202: INTRODUCTION TO OIL AND GAS INDUSTRY (2 CREDITS)

COURSE CONTENT:

Overview of Petroleum Engineering: Petroleum origin and migration; what is oil and where is it located; petroleum composition/properties and phase behavior. Overview of energy demand and supply of crude oil and gas. Exploration; Concept of Geology, importance of Geology in Exploration: Definition of traps, reservoir formations, etc. Exploitation: Basic Method of Drilling-Cable tool and Rotary Drilling Methods and equipment used, Introduction to other drilling methods; production: Oil and gas production – primary, secondary and tertiary methods Oil and gas production and gathering Oil and gas processing; Oil and gas transportation and refining. Government regulation and political influence on the oil and gas industry; Basic petroleum economics

LEARNING OUTCOMES

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

1. Describe the origin, formation, migration and entrapment of petroleum,
2. State the relevant aspect of supply and demand of crude oil and gas in Africa and the world
3. Discuss the role of geology in exploration and techniques employed for drilling and production of oil and gas.
4. Highlight key processing ,storage and transportation systems in petroleum industry .
5. Identify government regulation and political influence on the oil and gas industry

MEE212: APPLIED MECHANICS (2 CREDITS)

COURSE CONTENT:

Statics: Laws of statics, system of forces and their properties. Simple problems, friction.

i. Particle dynamics – Kinematics of plane motion. Newton's laws – kinetics of particles, momentum and energy methods.
ii. Kinematics of rigid bodies – velocity and acceleration diagrams for simple problems.
iii. Kinetics of rigid bodies – Two-dimensional motion of rigid bodies, energy and momentum, Mass moment of inertia. Simple problems.
iv. Simple harmonic motions.

LEARNING OUTCOMES

Students will acquire the ability to:

1. Explain the fundamental principles of applied mechanics, particularly equilibrium analysis, friction, kinematics and momentum.

2. Identify, formulate, and solve complex engineering problems by applying principles of

engineering, science, mathematics and applied mechanics.

3. Synthesize Newtonian Physics with static analysis to determine the complete load impact (net forces, shears, torques, and bending moments) on all components (members and joints) of a given structure with a load.

4. Apply engineering design principles to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.

EPS 221: INTRODUCTION TO ENTREPRENEURIAL SKILLS (2 CREDITS)

COURSE CONTENT:

Introduction to entrepreneurship and new venture creation; Entrepreneurship in theory and practice; The opportunity, forms of business, staffing, marketing and the new venture; Determining capital requirements, raising capital; Financial planning and management; Starting a new business, Feasibility studies; innovation; Legal issues; insurance and environmental considerations. Possible business opportunities in Nigeria.

LEARNING OUTCOMES

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

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

MEE242: MATERIALS SCIENCE (2 CREDITS)

COURSE CONTENT:

Atomic and molecular structure, crystals and amorphous structure. Metallic state. Defects in crystals. Conductors, semi-conductors and insulators.

i. Alloy Theory – Application to industrial alloys. Steel in particular.
ii. Engineering properties – Their control, hot and cold working, heat treatment, etc. Creep, fatigue and fracture. Corrosion and corrosion control.
iii. Non-metallic materials – glass, rubber, concrete, plastics, wood and ceramics.
iv. Elastic and plastic deformations: Defects in metals.

LEARNING OUTCOMES

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

1. Explain the relationship between structure and properties of materials, characteristics, components and compositions of phase diagrams and phase transformations of solid solutions.
2. Define metals, alloys and metalloids
3. Define ceramics, glass and constituents of glasses and understand application of ceramics in mining, building, art and craft industries.
4. Classify polymers as a class of engineering materials and polymeric materials, demonstrate polymerization reactions, their types and mechanism, and applications of polymers.
5. Discuss properties, types and application of composite materials and fibres (synthetic and natural) and identify applications of nanomaterials

MEE 262: FLUID MECHANICS I (2 CREDITS)

COURSE CONTENT:

i. Elements of fluid statics; density, pressure, surface tension, viscosity, compressibility etc.
ii. Hydro-static forces on submerged surfaces due to incompressible fluid.
iii. Introduction to fluid dynamics – conservation laws.
iv. Introduction to viscous flow.

LEARNING OUTCOME

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

1. Define fluid mechanics, fluid statics. Identify applications in engineering.
2. Derive the Bernoulli equation and apply to solve at least three fluid flow problems.
3. Solve at least four problems in transportation and metering of fluids, flow past immersed bodies.
4. Measure flow parameters with venturi meters, orifice meters, weirs, etc. pressure measurement
5. Derive Naiver-Stokes equations problems and state at least one distinguishing property of pumps, compressors and turbines and state their classifications.

ELA 202: ENGINEERING LABORATORY/WORKSHOP PRACTICE II (3 CREDITS)

COURSE CONTENT:

Performing Laboratory Tests and doing workshop practice, etc.

LEARNING OUTCOMES

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

1. Investigate data and solve problems while working as a team.
2. Understand and visualize theoretical knowledge.
3. Analyse and discuss experimental results.
4. Produce laboratory reports and conclusions based on statistical techniques.
5. Understand the importance of basic workshop safety.

EMA202: ENGINEERING MATHEMATICS II (3 CREDITS)

COURSE CONTENT:

(a) Further Integrations: Reduction formulae

(b) Differential Equations –

(i) General Review: Exact differential equations. Simple applications in geometry, mechanics, chemical reactions and heat flow.

(ii) Second Order linear differential equations with constant coefficients. Further D-operator method. Solution of second order differential equations by method of change of variables. Introduction to partial differential equations (separation of variables).

(c) Mechanical and Electrical Oscillations: Oscillations of damped and UN-damped mechanical systems. Electric circuit theory. Resonance.

(d) Numerical Methods: Introduction to numerical computation. Solution of non-linear equations. Solution of simultaneous linear equations-both direct and iterative schemes. Finite difference operators. Introduction to linear programming (Graphical solution).

LEARNING OUTCOMES

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

1. Describe physical systems using ordinary differential equations (ODEs). solve a wide range of ODEs,
2. Numerically solve differential equations using MATLAB and other emerging applications.
3. Perform calculus operations on vector-valued functions, including derivatives, integrals, curvature, displacement, velocity, acceleration, and torsion, as well as on functions of several variables, including directional derivatives and multiple integrals.
4. Solve problems using the fundamental theorem of line integrals, Green's theorem, the divergence theorem, and Stokes' theorem and Cauchy integral theorem
5. Apply the concept and consequences of analyticity and the Cauchy-Riemann equations and of results on harmonic and entire functions of complex variables, as well as the theory of conformal mapping to solve problems from various fields of engineering.

ECP202: IT IN ENGINEERING (2 CREDITS)

COURSE CONTENT:

Historical developments of Computers, External Components of computers, Characteristics of a computer, types and classification of hardware and software. Word processing: principle of operation, application, demonstration and practical hand- on exercises in word processing using a popular word processing package. Spread sheet: principle of operation, application, demonstration and practical hand- on exercises in the use of spread sheet to solve problems. Presentation software packages: principle of operation, application, demonstration and practical hand- on exercises in the use of popular report presentation package (such as power point). Mini project to test proficiency in the use of software packages. Database management Package: principle of operation, application, demonstration and practical hand- on exercises in the use of DBMS package in solving problems. MATLAB: principle of operation, application, demonstration and specific functions/toolboxes to solve specific engineering problems.

LEARNING OUTCOMES

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

1. Analyze computer development historically.
2. Discuss the concept of Word processing, Spread sheet and Presentation software packages in computers.
3. Install and configure software packages on a computer.
4. utilize MATLAB and the DBMS package for problem solving.

EEE212: ELECTRICAL ENGINEERING II (3 CREDIT)

COURSE CONTENT:

Physics of Devices: Atomic structure, material classification, election emission, gas discharge devices, semiconductor materials, p-n junction diode and transistor. Transistor amplifier, D.C. and A.C. analysis of transistor amplifier circuits. Transistor switching characteristics. Rectification and D.C. power supplies, Transformers, Introduction to DC and AC machines.

LEARNING OUTCOMES

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

1. Discuss the fundamental concepts of electricity and electrical d.c. circuits
2. State, explain and apply the basic D.C. circuit theorems
3. Explain the basic A.C. circuit theory.
4. Enumerate transistor switching characteristics
5. Discuss the key areas in the workings of Transformers

GST 221: PEACE STUDIES AND CONFLICT RESOLUTION (2 CREDITS)

COURSE CONTENT:

Basic concepts in peace studies and conflict resolution. Peace as vehicle of unity and development. Conflict issues, Types of conflicts 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**.**

LEARNING OUTCOMES

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

1. Analyze the concepts of peace, conflict and security.
2. List major forms, types and root causes of conflict and violence.
3. Differentiate between conflict and terrorism.
4. Enumerate security and peace building strategies.

5. describe the roles of international organizations, media and traditional institutions in peace building.

GST224 LEADERSHIP SKILLS (2CREDITS)

COURSE CONTENT:

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, breaking initiatives, gender and leadership coaching and leadership enrollment conversation and forming and leading teams will be taught

LEARNING OUTCOMES

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

1. Build the skill required to appropriately distribute leadership deep into any business unit/ organization.
2. Learn how to execute initiatives effectively with others.
3. Gain a deeper understanding and develop the requisite skills to create a high-performance culture through alignment (performance and psychological).
4. Build effective coaching skills to draw out talents and strengths in service of team and organizational objectives.

IUITS 202 IGBINEDION UNIVERSITY INDUSTRIAL TRAINING SCHEME (1 CREDIT)

Course Outline

Practical experience in a workshop or industrial production facility, construction site or special centres in the university environment, considered suitable for relevant practical/industrial working experience but not necessarily limited to the student's major. The students are exposed to hands-on activities on workshop safety and ethics, maintenance of tools, equipment and machines, carpentry, welding, fabrication and foundry equipment, production of simple devices; electrical circuits, wiring and installation, etc. (A 6-week intensive training program within the university). Introductory lectures in different fields of engineering; Exposure and visits to engineering project sites within the university, neighbourhood and visit to engineering based establishments. Students submit and defend reports at the end of the exercise. They also write examination.

IUITS 202 IGBINEDION UNIVERSITY INDUSTRIAL TRAINING SCHEME (1 CREDIT)

LEARNING OUTCOMES

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

1. Acquire industrial workplace perceptions, ethics, health and safety consciousness, interpersonal skills and technical capabilities needed to give them a sound engineering foundation
2. learn and practice basic engineering techniques and processes applicable to their specializations
3. build machines, devices, structures or facilities relevant to their specific engineering programme and applications.
4. acquire competence in technical documentation (log-book) and presentation (report) of their practical experiences.
5. Develop report writing skills

300 LEVEL PETROLEUM ENGINEERING COURSE STRUCTURE

TABLE 1.9: 300 LEVEL FIRST SEMESTER WORKLOADS BY STUDENTS

Course Code	Course Title	Unit	Status	Prerequisite	Contact Hours/ Week			Total Week Load
					L	**T**	**P**	
EMA 301	Engineering Mathematics III	3	**Core**	EMA201, EMA 202	2	1	-	3
EPS 311	Introduction to Entrepreneurial Studies	2	**Core**		1	1	-	2
GRE331	Research Methods and Technical Report Writing	2	**Core**		2	-	-	3
CVE311	Engineering Analysis	3	**Core**	MEE231	2	1	-	3
PEE301	Petroleum Engineering Laboratory I	2	**Core**	ELA201, ELA202	2	-	6	8
PEE303	Industrial Studies I	2	**Core**		1	1	-	2
PEE 321	Reservoir Engineering 1: Rock and Fluid Properties	3	**Core**		2	1	-	3
PEE331	Heat and Mass Transfer	3	**Core**		2	1	-	3
PEE 341	Petroleum Engineering Rock Mechanics	3	**Core**		2	1	-	3
	1st Semester Total Credit Units	**23**						

300 Level Second Semester Work Load by Students								
Course Code	**Course Title**	**Unit**	**Status**	**Prerequisite**	**Contact Hours/ Week**			**Total Week Load**
					L	**T**	**P**	
EMA 302	***Engineering Mathematics IV***	3	**Core**	EMA 301	2	1	-	3
CHE 362	Transport Phenomena	3	**Core**		2	1	-	2
PEE302	Petroleum Engineering Laboratory II	2	**Core**	PEE 301	-	-	6	6
PEE322	Petroleum Geology	3	**Core**		2	1	-	3
PEE332	Drilling Fluids Systems and Technology	2	**Core**		1	1	-	2
PEE342	Drilling Technology I	3	**Core**		2	1	-	3
PEE352	Petroleum Production Engineering I	3	**Core**		2	1	-	3
PEE304	Industrial Studies II	2	**Core**	PEE303	1	1	-	2
IUITS 302	Igbinedion University Industrial Training Scheme.	1	**Core**		-	-	-	1
	2nd Semester Total Credit Units	**22**						
	Total Sessional Credit Units	**45**						

FIRST SEMESTER

PEE 301: PETROLEUM ENGINEERING LABORATORY I (2 CREDITS)

COURSE CONTENT:

(PVT/Core Analysis Laboratory)

Analysis of drill cutting: Determination of porosity, fluid saturations, capillary pressure, permeability, electric properties, effective permeability and relative permeability. Physical properties of petroleum and its product, gravity, viscosity, surface tension, thermodynamic behavior of naturally occurring hydrocarbon mixture, differential and flash vaporization tests at elevated pressure and temperatures.

LEARNING OUTCOMES

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

1. Analyze drill cuttings.

2. Determine the lithology of a given formation.

3. Determine rock properties (porosity, permeability, fluid saturations, capillary pressure curves and others) and fluid properties (bubble point pressure, dew point pressure and oil formation volume) .

GRE 331: RESEARCH METHODS AND TECHNICAL REPORT WRITING (2 CREDITS)

COURSE CONTENT:

Principles of communication. Parts of technical reports: Abstract, introduction, Main body. Conclusions and Recommendations, Tables, Figures, Graphs, Illustration, References, Appendices. Writing the first draft. Revising the first draft: Content and structure. Audiences Scientific and Technical Prose: Spelling and Scientific Terminology using numbers and symbols. Data: Statistical analysis of data and display. Software support for various writing and graphic tasks. Use of Microsoft power point. Preparation of curricula vitae, research grant proposals, short talks and poster, and feasibility report. Writing a thesis employed in marine environment.

LEARNING OUTCOMES

Upon successful completion of this course, students will be able to:

1. Describe and explain key research concepts, issues, types of research and the systematic process of research gap identification .
2. Formulate and evaluate research objectives, questions and hypotheses and develop research proposal or industry project plan.
3. Use appropriate tools/techniques, including computer soft-ware and hardware /technologies to interpret, discuss and report/present the result and conclusions derived from research data analysis in oral or written form.
4. Prepare/format/package research results/output for academic, journal articles, technical and other reports and exhibitions/fairs (scientific, trade, etc.) as an individual or team/work group.
5 .Demonstrate good interpersonal communication skills through hands-on and constant practice on real-life communication .

PEE 303: INDUSTRIAL STUDIES I (2 CREDITS)

COURSE CONTENT:

Introduction to the organizational structure of manufacturing organizations. Evolution of an industrial, domestic, and commercial product from society's needs, or market survey, problem definition, design tools- simulation, graphs and layouts; feasibility studies. Team implementation/manufacture of selected simple engineering products for industrial, domestic and commercial purposes.

LEARNING OUTCOMES

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

1. Apply areas of operation management relevant to the engineering profession.
2. Interpret and understand management structures and functions within an organization.
3. Demonstrate an in-depth knowledge of the various sectors of global industries and common industrial practices.
4. Develop work habits and attitudes necessary for job success (technical competence, professional attitude, organizational skills etc.).

PEE 321: RESERVOIR ENGINEERING I: ROCK AND FLUID PROPERTIES (3 CREDITS)

COURSE CONTENT:

Fundamental properties of single and multiple fluid saturated rocks: porosity, permeability, relative permeability, fluid saturations, electrical resistivity capillary pressure. Surface forces, wettability, compressibility, static distribution of fluids, electric conductivity, correlations between rock properties. Behavior of liquids, phase equilibrium, Viscosities of hydrocarbons, Use of fluid properties in Reservoir Engineering, Rock and fluid property correlations.

LEARNING OUTCOMES

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

1. Summarize fundamental properties of single and multiple fluid saturated rocks
2. Discuss properties of reservoir rock, compare correlations, perform calculation using rock and fluid property correlations
3. Explain static distribution of fluids, electric conductivity,
4. State the concept of phase equilibrium,
5. estimate the viscosities of hydrocarbons and highlight the relevance of fluid properties in Reservoir Engineering,

PEE331: HEAT AND MASS TRANSFER (2 CREDITS)

COURSE CONTENT:

Models of heat transfer, general heat conduction equation, steady state conduction, unsteady heat transfer by convection, natural and forced, laminar and turbulent. Heat transfer by radiation, fundamentals of black and gray bodies, combined models of heat transfer, radiation exchange between surfaces. Heat exchangers, conductors and dryers. Mass transfer fundamentals, diffusion and convection mass transfer.

LEARNING OUTCOMES

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

1. Enumerate the modes of heat transfer and their applications.

2. Apply heat and mass transfer principles to steady-state and, unsteady-state processes.

3. Determine overall transfer coefficient.

4. Apply heat and mass transfer principles to heat exchangers, conductors and dryer.

5. Differentiate between heat, mass and momentum.

PEE 341: PETROLEUM ENGINEERING ROCK MECHANICS (3 CREDITS)

COURSE CONTENT:

Fundamentals of rock mechanics. Crater formations; plastic and pseudo plastic characteristics of rocks load rate mechanism; static and impact loading; tooth penetration as a function of differential and overburden pressure. Effect of differential pressure on drilling rate. (a). A review of Basic geological concepts principles. (b). Principles of Stress and Strain: (i). Basics of stress and strain (ii). Mohr circles (iii). Effective stress concepts and the importance of pore pressure (iv). In-situ stress tensor (v). Stress field variations – structural effects (vi). Stress measurements and analysis. (c). Pore Pressure Evaluation and Estimation (i). Basic concepts (ii). Causes of over pressure (iii). Analysis Concepts: NCT, Bowers, Centroid-Effect (iv). Analysis workflow. (d). Mechanical Rock Behavior: (i). Mechanical properties – elasticity and other stress-strain behavior (ii). Failure and beyond (iii). Thermal effects (iv). Influence of faults and fractures (v). Laboratory vs. log vs. field data. (e). Geo-mechanically Modeling: (i). Concepts and tools (ii). 1D/2D modeling. (f). Geo-mechanics as applied to Petroleum Engineering: (i). Well-bore stability (ii). Compaction/subsidence (iii). Completions (sanding) (iv) Completions (stimulation), etc.

LEARNING OUTCOMES

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

1. Determine physical properties of rock (density, porosity, permeability, and hardness.).
2. Determine mechanical properties of rock (axial compressive strength, triaxial compressive strength, point load strength and slake durability.).
3. Explain and measure the elastic behavior of rocks.
4. Carry out stability analysis of various natural and artificial rock slopes.

5. Apply rock science software to Produce the Mohr envelope, analyze various slopes and determine factor of safety.

CVE 311: STRENGTH OF STRUCTURAL MATERIALS 3 CREDITS

COURSE CONTENT

Columns: Short columns (struts); Intermediate columns and slender columns. Fully restrained, partially restrained and unrestrained columns. Analysis of Columns: By Euler ‘s Theoretical Formulae and Empirical Methods such as: Gordon Rankine ‘s formula; Johnson ‘s Parabolic and Straight-line formula. Loading and Bending of Columns: Symmetrical and eccentric loading of columns and bending about one axis (uni-axial bending) and bending about two axes (tri-axial bending). Analysis of Trusses and Frames. Determination of degree of indeterminacy or redundancy of trusses and frames. Analysis of Perfect or Statically Determinate Trusses and Frames. Calculation of external support reactions, internal forces (tension and compression) and deformation in bar members, using both analytical methods of joints and method of sections or moment as well as graphical methods. Shear centre; unsymmetrical bending; curved beams. Biaxial and Tri-axial state of stress: transformation of stresses; Mohr ‘s circle; Failure Theories. Creep, Fatigue, Fracture and Stress concentration. Springs.

LEARNING OUTCOMES

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

1. Enumerate types of columns and perform calculations on the various types
2. List methods of analysis of Columns and apply them in solving related problems (By Euler ‘s Theoretical Formulae and Empirical Methods such as: Gordon Rankine ‘s formula; Johnson ‘s Parabolic and Straight-line formula).
3. Solve problems on Loading and Bending of Columns: Discuss the theory of Mohr ‘s circle
4. Carry out analysis of Trusses and Frames.
5. Calculation of external support reactions, internal forces (tension and compression) and deformation in bar members, using both analytical methods of and method of sections or moment ($M = 0$) as well as graphical methods.

EMA 301: ENGINEERINGMATHEMATICS III (3 CREDITS)

COURSE CONTENT:

a) Linear Algebra: Elements of Matrices, determinants, inverse of a matrix. Theory of a system of linear equations. Eigenvalues and Eigenvectors of a matrix.
b) Analytic geometry: coordinate transformation. Solid geometry. Polar, cylindrical and spherical coordinates.
c) Functions of several variables: Mean value theorem of function of several variables, maxima and minima, differentiation under the sign of integration. Jacobians.
d) Numerical Analysis: Numerical differentiation and **quadrature formulae**. Analytic and numerical solution of ordinary differential equations. Curve fitting. Simple linear programming (simplex method).

LEARNING OUTCOMES

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

1. Explain the theoretical basis of Linear Algebra, Elements of Matrices and Solve problems accurately
2. Solve problems in Analytic geometry
3. Solve problems in Functions of several variables:
4. Demonstrate an understanding of Numerical Analysis and Solve problems in Numerical differentiation and **quadrature formulae**.

EPS 311: INTRODUCTION TO ENTREPRENEURSHIP STUDIES (2 CREDITS)

COURSE CONTENT:

Some of the ventures to be focused upon include the following:

1. Soap/ Detergent, Tooth brushes and tooth paste making
2. Photography
3. Brick, nails, screws making
4. Dyeing/ Textile blocks, paste making
5. Rope making
6. Plumbing
7. Vulcanizing
8. Brewing
9. Glassware production/ Ceramic, production
10. Paper production
11. Water treatment/ Conditioning/ Packaging
12. Food processing/ Packaging/ Preservation
13. Metal working/ Fabrication- Steel aluminum door and windows
14. Training Industry
15. Vegetable oil/ Salt extractions
16. Fisheries/ Aquaculture
17. Refrigeration/ Air conditioning
18. Plastic making
19. Crop farming
20. Domestic Electrical wiring
21. Radio/ TV repairs
22. Carving
23. Weaving
24. Brick laying / making

2 Bakery

26. Tailoring
27. Iron Welding
28. Building drawing
29. Carpentry.
30. Leather tanning
31. Interior decoration

32. Printing
33. Animal husbandry (Poultry, piggery, goat, etc.)
34. Metal craft: Blacksmith, Tinsmith, etc.
35. Sanitary wares
36. Vehicle maintenance
37. Book keeping.
38. Computer installation and repairs

LEARNING OUTCOMES

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

1. Explain the concepts and theories of entrepreneurship, intrapreneurship, opportunity seeking, new value creation and risk-taking.
2. State the characteristics of an entrepreneur and key elements of principles of e-commerce.
3. Analyze the importance of micro and small businesses in wealth creation, employment generation and financial independence.
4. Engage in entrepreneurial thinking and identify key elements in innovation and identify stages in enterprise formation and networking, including business planning
5. Describe contemporary entrepreneurial issues in Nigeria, Africa and the rest of the world.

SECOND SEMESTER

PEE302: PETROLEUM ENGINEERING LABORATORY II (2 CREDITS)

COURSE CONTENT:

(Drilling Mud / Cement Laboratory)

Mud preparation and treatments, measurement of drilling and well completion fluid properties, Cements types, properties and testing, laboratory observations of reactions between drilling and workover fluids on formation, Rheology, filtration and relations between drilling functions and measure drilling mud and completion fluid properties.

LEARNING OUTCOMES

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

1. Investigate data and solve problems while working as a team.
2. Understand and visualize theoretical knowledge of Rheology, filtration and relations between drilling functions.
3. Analyze and discuss experimental results of various drilling muds and cement types.
4. Produce laboratory reports and conclusions based on statistical techniques.
5. Understand the importance of basic laboratory safety.

CHE 362: TRANSPORT PHENOMENA (3 CREDITS)

COURSE CONTENT:

Introduction: Definitions and principles. Fluid statics and its applications. Basic equation of fluid flow. Bernoulli's equation. Flow of in compressible fluids. Flow of compressible fluids. Flow past immersed bodies. Fluid friction in one-dimensional flow. The momentum balance. Transportation and metering of fluids. Agitation and mixing of fluids. Pumps, compressors and turbines. Flow through porous media. Non-Newtonian fluids.

LEARNING OUTCOMES

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

1.Define Fluid statics and its applications.

2. Identify Basic equations of fluid flow.

3. Derive the Bernoulli's equation and explain its application

4. describe Flow of compressible fluids and Flow past immersed bodies.

5. Discuss Transportation and metering of fluids. Agitation and mixing of fluids

PEE 304: INDUSTRIAL STUDIES II (2 CREDITS)

COURSE CONTENT:

Study of projects and contract documents for the various branches of Engineering; Drawing Bill of Quantities, Identification of materials, material location, Quantity, Quality and handling requirements; Specification, Quality control and Measurements, Safety and Safety procedures.

LEARNING OUTCOMES

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

1. Outline various industrial safety procedures.
2. Outline the steps used in quality control.
3. Identify key areas in drawing Bill of Quantities
4. Identify various materials and their locations.
5. Understand contract documents related to various branches of engineering.

EMA 302: ENGINEERING MATHEMATICS IV (3CREDITS)

COURSE CONTENT:

a) Fourier series: Euler coefficients. Even and odd functions. Sine and Cosine functions; simple applications.
b) Gamma, Beta and probability function (emphasis rather on the applications).

c) Differential Equations: Linear second order equations reducible to linear equation with constant coefficients. Series solution of differential equation. Legendre and Bessel functions and their properties.

d) Vector Field Theory: Dot product, cross product, divergence. Curl and Del operators. Gradient. Line, surface and volume integrals, and related theorems.

LEARNING OUTCOMES

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

1. Solve second order differential equations.
2. Solve partial differential equations.
3. Solve linear integral equations.
4. Relate integral transforms to solution of differential and integral equations.
5. Explain and apply interpolation formulas, Runge-kutta and other similar methods in solving ode and pdes

PEE 322: PETROLEUM GEOLOGY (3 CREDITS)

COURSE CONTENT:

Elements of Geology: Revisions: Geology and Petroleum, Geology of Petroleum, Origin, Migration, Accumulation, Recovery, Geologic Time Scale: Age of the Earth, Depositional Processes and Environments, Geologic Basins and Rocks, Structural Geology, Stratigraphy, Sedimentary Rocks: Texture, Structure and Composition of Rocks, Source Rocks, Origin and Migration of Petroleum, Traps and Seals: Definitions and Classifications, Reservoir Rocks, Accumulation of Petroleum, Necessary and Sufficient Conditions for Accumulation of Petroleum, Properties of Sedimentary Rocks. Exploration for Sedimentary Rocks: Surface Geologic Methods, Geo-physical Methods for Subsurface Exploration, Drilling and Formation Evaluation Methods. Map Elaboration: Facies and Facies maps, Cross sectional Analysis; Profiles Construction, Planimeter Method, Structural Maps; Iso-pach, Iso-baric Maps. Resources Volumes and Reserves: Types of Resources in Place, Conditions of Existence, Initial Volumes in Place, Reserves. Recovery and Recovery Mechanisms: Primary Energy, Supplementary Energy. Petroleum Geology of Nigeria, Stratigraphy, Major Basins in Nigeria, Producing Basins and Geology.

Petroleum Prospecting, uses of geological data, reservoir rocks, reservoir fluids, traps, origin of oil and gas geology of the Niger Delta and Lake Chad Basin. Geophysics.

LEARNING OUTCOMES

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

1. discuss fundamentals of Geology that need to be understood and integrated with engineering data to effectively and optimally manage petroleum reservoirs.

2. identify Conditions necessary for Petroleum formation and accumulation.

3. Enumerate various methods of evaluating source rock potential and state differences and peculiarities of some Nigerian basins.

4. State variety of geologic data that are integrated together to carefully describe the three-dimensional geometry of a reservoir.

5. Prepare various subsurface maps and calculate reserves.

PEE 332: DRILLING FLUIDS TECHNOLOGY (2 CREDITS)

COURSE CONTENT:

Functions and composition of drilling fluids. Mud properties; testing, classification and chemical analysis. Drilling mud calculations. Control of mud properties. Well completion fluids. Drilling mud performance.

LEARNING OUTCOMES

At the end of the course, students should be able to:
1. Enumerate the functions of drilling fluids and how their rheological properties are affected by physical and chemical additives.
2. Explain laboratory measurement of drilling fluid properties.
3. Distinguish between damaging and non-damaging drilling fluids.
4 Appraise drilling mud performance.

PEE 342: DRILLING TECHNOLOGY I (3 CREDITS)

COURSE CONTENT:

Techniques for oil well drilling, Drilling rigs: equipment, hoisting, drill string, casing, drill bits. Circulating system, drilling fluids, drilling hydraulics. Well head equipment. Drilling and Casing programs. Drilling performance. Offshore drilling rig: Introduction to Drilling Engineering; Fundamental concepts in oil well drilling, Basic Drilling Methods; Cable Tool and Rotary Drilling methods, Introduction to other Drilling Methods; Drilling Rigs; Rotary drilling rigs components and systems, their functions and selection,- rig power system, hoisting system, circulation system, the rotary system, the well control system, well-monitoring system, special marine equipment of an , Drill Strings .Bit types available; Rock failure mechanisms; Bit selection and evaluation; Factors affecting tooth wear, bearings wear, terminating a bit run. Factors affecting penetration rate, bit operation, drilling fluids and drilling hydraulics, well head equipment; Formation pressure prediction, Fracture gradient prediction; Drilling operation and drilling cost analysis; Overview of drilling and casing programs. Drilling performance evaluation, drilling report format.

LEARNING OUTCOMES

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

1. Demonstrate understanding of the fundamentals of oil well drilling especially the techniques employed for oil well completion.
2. Explain Bit selection and evaluation and bit's ability to drill through reservoir rock by considering bit tooth wear on bit bearings and how to terminate the bit run.
3. Plan a drilling operation to include cost estimation, assemblage of a Drilling team, rigs and rig power systems and hoisting.
4. Prepare a drilling report

PEE 352: PETROLEUM PRODUCTION ENGINEERING I (3 CREDITS)

COURSE CONTENT:

Introduction to Petroleum Production Engineering: subsurface operations. Operational functions and output of subsurface production engineer. Well completion: tubing, types, tubing equipment, uses of tubing, calculations. use of wirelines. packers-types; uses. Multiple zone completion. Well heads - casing and tubing hangers. Christmas tree. Nodal analysis in flow and outflow performances: governing equations, inflow performance relationship (IPR), productivity index, formation damage, fines migration and skin effect, vertical lift well head equipment performance and pressure losses, choke performance. Problem wells analysis: sand, water, hydrate, scale, unstable flow, surge, waxy crude production, etc. Well surveillance. Well stimulation: Fracturing and acidizing. Introduction to artificial lift methods. Gas lift and pumping system. Computer Application for Nodal Analysis (Proper or alternative)..

LEARNING OUTCOMES

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

1. Explain the operations and equipment required for subsurface completion.
2. Discuss pressure losses in subsurface completion equipment.
3. Explicate inflow-outflow relationship and implications in the life of the well.
4. identify the basic concepts in artificial lifting (gas lift, pumping, et cetera) of oil.
5. Discuss formation damage: Sources, implications and remedies and use of nodal analysis software.

IUITS 302 IGBINEDION UNIVERSITY INDUSTRIAL TRAINING SCHEME 1 CREDIT
COURSE OUTLINE

A 3-month intensive industrial training scheme taken in engineering-based establishments. Students submit logbook and written reports at the end of the exercise. Study of oil and gas industry, learning of software of oil and gas industry for applications in Petroleum Engineering, Gas Engineering, oil, and gas Engineering. Software such as PIPESIM, , PETREL, PROPER, ECLIPSE, ASPEN HYSYS PACKAGES, QUESTO, Oil field Manager. Use of animation videos for oil and gas industry.

LEARNING OUTCOMES

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

1. Acquire industrial workplace perceptions, ethics, health and safety consciousness, interpersonal skills and technical capabilities needed to give them a sound engineering foundation
2. learn and practice basic engineering techniques and processes applicable to their specializations
3. Acquire competence in technical documentation (log-book) and presentation (report) of their practical experiences.
4. Acquire skill in software application and analysis

400 LEVEL PETROLEUM ENGINEERING COURSE STRUCTURE

TABLE 1.10: 400 LEVEL FIRST SEMESTER WORKLOADS BY STUDENTS

Course Code	Course Title	Unit	Status	Prerequisites	Contact Hours/Week			Total Week Load
					L	**T**	**P**	
PEE401	Petroleum Engineering Laboratory III	2	**Core**	PEE301, PEE302	-	-	6	6
CERT411	Career Enhancement and resilience training	2	**CORE**		2	-	-	2
EMA401	Engineering Mathematics V	3	**Core**	EMA 301. EMA 302	2	1	-	3
PEE 403	Industrial Studies III	2	**Elective**	PEE304	1	1	-	2
PEE411	Drilling Technology II	3	**Core**	PEE342	2	1	-	3
PEE 421	Applied Geophysics and Petroleum Evaluation	2	**Core**		2	1	-	3
PEE431	Well Test and Analysis	2	**Core**		2	1	-	3
PEE451	Well Logging and Interpretations	3	**Core**		2	1	-	3

PEE461	Reservoir Engineering II	3	**Core**	PEE 321 CHE 361	2	1	-	3
PEE471	Petroleum Production Engineering II	3	**Core**	PEE352	2	1	-	3
CHE441	Petroleum Refining Processes	3	**CORE**	CHE441	2	1		3
PEE481	Computer Application in Petroleum Engineering	2	**Elective**		1	1		2
	1st Semester Total Credit Units	**30**						
400 Level Second Semester Work Load For Students								
IUITS 402	Students Industrial work experience Scheme	6	Core	IUITS 302				
	Total Sessional Credit Units	**36**						

PEE401: PETROLEUM ENGINEERING LABORATORY III (2 CREDITS)

COURSE CONTENT:

Rheological measurements: Waxy and non – Waxy Crude; Flow metering of liquids and gas: Determination of meter accuracy. Uses and Operations of various pressure regulators: Pressure loss measurement along pipes. Determination of friction factors; Bottom hole pressure determination: Oilfield quality control; Oilfield chemical tests; setting-up of Project laboratory. Prerequisite PEE301, PEE302.

LEARNING OUTCOME

On completion of the course the students should be able to

1. Demonstrate practical skills on Rheological measurements: Waxy and non – Waxy Crude;
2. Flow metering of liquids and gas and Determine meter accuracy.
3. Identify and describe how to estimate Pressure loss measurement along pipes
4. . Determination of friction factors; Bottom hole pressure determination: Experiment on Oilfield quality control; Oilfield chemical tests;

5. Develop team spirit , communication skills and leadership abilities

CERT411: CAREER ENHANCEMENT AND RESILIENCE TRAINING (1 Credit)

Course content

Module 1: The Perspective Module (Understanding career perspectives and opportunities, Module II: The Personal Module; (Understanding yourself and career equilibrium), Module III: The Partnership Module (Understanding networks and other career resources), Module IV: The Planning Module; (Recap and understanding career planning). Specific contents include; Introduction to CERT411, Problems and Opportunities, understanding your current and future professional self, discovering yourself. Converting lobbies and interest to passions and profits. The three career E-Routes, Understanding the power of Networks and partnership, Career resources of time and skills, career resources of funding, career planning..

LEARNING OUTCOME

On completion of the course the students should be able to

1.Discuss career perspectives and opportunities,

2. personal understanding of goals and capability

3.develop networks and other career resources

4.Identify Problems and Opportunities,

5.Recognise Career resources of time and skills, funding and career planning

EMA 401: ENGINEERING MATHEMATICS IV (3 CREDITS)

COURSE CONTENT:

Complex variables – advanced topics; differentiation and integration of complex functions. Cauchy-Riemann equations: Related theorems. Laplace and Fourier transforms – applications. Probability – Elements of probability, density and distribution functions, moments, standard distribution, etc. Statistics – Regression and correlation – Large sampling theory. Test, hypothesis and quality control.

LEARNING OUTCOME

On completion of the course the students should be able to

1. **Describe** Complex variables – advanced topics;
2. differentiation and integration of complex functions. Cauchy-Riemann equations: Related theorems.
3. Evaluate Laplace and Fourier transforms problems – applications.
4. Compute Probability related problems – Elements of probability, density and distribution functions, moments, standard distribution, etc. Statistics – Regression and correlation – Large sampling theory.
5. discuss and perform calculations on test, hypothesis and quality control.

PEE 403: INDUSTRIAL STUDIES III (2 CREDITS)

COURSE CONTENT:

Group technology tasks: these may involve group design and manufacture of prepared drawings, specifications and planning schedules, a viable commodity which has a tested performance, and acceptable standard of finish and time and cost constraints, under a chosen leader, service and maintenance group tasks etc. (Emphasis is for student to appreciate the necessity to use people, materials and equipment to the best economic conditions and the need for personal relationship and acceptance of responsibility when working as part of a team). Team work and leadership. Service and maintenance group tasks.

LEARNING OUTCOME

On completion of the course the students should be able to

1. Outline at least five steps used in quality control and outline two methods of group technology tasks.
2. State at least two ways of identifying new market opportunities.
3. Identify at least three design tools used in product design and development.
4. Enumerate at least four factors affecting Feasibility studies.
5. Discuss at least four basic stages in team implementation works.

PEE 411: DRILLING TECHNOLOGY II (3 CREDITS)

COURSE CONTENT:

Hydro-static pressure, Pore pressure and Fracture gradient calculations. Pressure control and blowout prevention: The need to control pressure, BOP valves; stack choke line and choke manifolds; choice of BOP system; control of kick; Subsurface pressures and mud Hydro-static pressure; Data for executing kick control; Indications of kick; Methods of circulating out a kick- Balanced Bottom hole Pressure method (BBHP), driller's method; kick when tripping; gas out mud.

Cementing: Equipment; hole conditions; volume calculations and rate of circulation; Squeeze cementing; cement plug.

Fishing: Fishing tools; Objects lost in the hole; fishing methods.

Casing design: Mechanical properties – tension, collapse and burst; designing a casing string.

LEARNING OUTCOME

On completion of the course the students should be able to

1. Discuss concept of Hydro-static pressure,
2. Perform Pore pressure and Fracture gradient calculations.
3. explain methods of Pressure control and blowout prevention:
4. identify and collect Data for executing kick control and identify indications of kick; methods of circulating out a kick
5. Discuss key areas in well cementing, equipment, hole conditions, volume calculations and rate of circulation, Squeeze cementing, cement plug.

PEE 421: APPLIED GEOPHYSICS AND PETROLEUM EXPLORATION (2 CREDITS)

COURSE CONTENT:

The scope of geophysics; solid earth geophysics; the shape of the earth; geomagnetism; marine geophysics; intestacy. Introduction to geophysical technologies (seismic, gravity, magnetic, resistivity) Geophysical instruments, field data processing, electrical, seismic, radiometric, etc.). Geophysical logging of borehole. Geophysical prospecting and exploration. Geophysical data acquisition, processing and interpretation in petroleum geology and economic minerals. Borehole logging and analysis. Elements of basin analysis.

LEARNING OUTCOMES

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

1. Apply the fundamental principles of geophysics applied to oil and gas industry.
2. Explain elastic theory and wave propagation in different formations.
3. Describe geophysical logging of borehole and distinguish between Geophysical prospecting and exploration.
4. Explain methods of geophysical data acquisition, processing and interpretation in petroleum geology and economic minerals.
5. Identify elements of basin analysis.

PEE431: WELL TESTING AND ANALYSIS (2 CREDITS)

COURSE CONTENT:

Review of fundamental flow equations. Well-bore damage and skin, Pressure Build-up Analysis. Horner's method of solution. Type curve analysis: Fluid property approximations; calculation of average pressure, method of superposition test design. Pressure Draw down Analysis: (Conventional methods: Reservoir limits test, Type Curves, test design). Fractured Reservoirs: Flow behaviour, fracture detection: Injection Well Testing: (Fall of analysis, injectivity test, step rate test). Testing Methods: drill stem testing, interference testing. Pulse testing: SFT. . Multi-rate Testing: (analysis with pressure and Pseudo-pressure method, deliverability testing, reservoir limits test).

LEARNING OUTCOME

On completion of the course the students should be able to

1. Enumerate relevance, types of well testing and list at least four (4)information that can be obtained from it
2. Discss differential equations often used to model flow of fluids and useful solutions to the Diffusivity equation
3. State Principle of Superposition, Horner's approximation and analyze its applications in well testing
4. Understand the phenomenon of skin, wellbore storage and its effect on well data

5. Evaluate the use, analysis method of a buildup test and a drawdown test and perform type curve matching process with examples

PEE 451: WELL LOGGING AND INTERPRETATIONS (3CREDITS)

COURSE CONTENT:

Well logging devices, principles and technology. Electrical, radioactive, acoustic/velocity, caliper, inclinometer, dipmeter and thermometer logs. Well log interpretation. Use of combination logs, cross plots. Production logging. Computer processing of logs. Measurements-while-drilling systems.

LEARNING OUTCOMES

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

1. Explain the principles of open and cased hole logging tools.
2. Read linear and logarithmic log curves and identify the lithological sequence penetrated in the well.
3. Calculate parameters needed for formation evaluation and movable and residual hydrocarbons
4. State the use of techlog or petrel in log analysis.
5. Evaluate recent advances in logging and log analysis.

PEE 461: RESERVOIR ENGINEERING II (3 CREDITS)

COURSE CONTENT:

Introduction: Functions of a reservoir engineer. Reservoir Fluid behavior. Fluid sampling. PVT analysis. Characteristics of petroleum reservoir. Determination of hydrocarbon in-Place for oil and gas recovery: volumetric methods; material balance and applications Reservoir drive indices . Computer application (MBAL or alternative). Concept of fluid flow through porous media. Darcy's law. Steady state and transient fluid flow in reservoirs. Displacement of oil and gas.

LEARNING OUTCOMES

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

1. Discuss Reservoir Fluid behavior and characterization of a petroleum reservoir based on PVT,
2. Identify uses of fluid sampling, method and equipment
3. Perform in-situ-evaluation of oil and gas reserve and discuss ways to recover the hydrocarbons.
4. Highlight component of Darcy's law and apply fluid flow concepts to recover hydrocarbons from the oil well.
5. Enumerate the uses and component of MBE, perform calculation and drive indices

PEE 471: PETROLEUM PRODUCTION ENGINEERING II (3CREDITS)

COURSE CONTENT:

Surface completion: Gathering systems: service and cleaning systems; design and testing of flow lines. Emulsion problems; oil emulsions; emulsifying agents and demulsifiers; choice and dosage of demulsifiers. Separation and separators; heat treatment. Dehydration: need for dehydration of gas; dew-point depression; absorption with glycol and absorption with solids.

LEARNING OUTCOMES

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

1. Discuss the key areas in the hydrocarbon Gathering systems at the surface
2. Apply the concept of fluid separation using different types of separators;
3. Discuss at least five (5) Emulsion problems
4. Explain the problems with fluid separation: emulsion, foaming, dehydration and treatment processes.
5. Undertake Separator and Compressor Design and explain the thermodynamics of compressors and compressor efficiencies.

CHE 441: PETROLEUM REFINING TECHNOLOGY (3 CREDITS)

COURSE CONTENT

Petroleum processing equipment; storage tanks; rectification columns; heat exchange apparatus; pipe furnaces; pipelines and fittings; compressors and pumps. Preliminary processing. Thermal processes; thermal cracking; coking; pyrolysis. Catalytic processes; brief description; catalytic cracking; catalytic reforming; hydrogenation processes; hydrogen cracking.

LEARNING OUTCOME

On completion of the course the students should be able to

1. Understand the need to refine petroleum and have an overview of the technology used

2. Enumerate the key Petroleum processing equipment utilized in the process of refinning

3.Discuss key areas in Preliminary processing.

4. Explain what and types of thermal refining processes. tilized in the Industry

5. Elucidate on the Catalytic processes used in the industry.

PEE 481: COMPUTER APPLICATIONS IN PETROLEUM ENGINEERING (2CREDITS)

COURSE CONTENT:

Introduction to computers and programming languages; Areas of Petroleum Engineering requiring computer applications; Various Programming language; Applications of programming Language to Petroleum Engineering problems - perform decline curve analysis and P/Z analysis, create Well-bore schematics, optimize gas wells and gas gathering systems; use hydrocarbon process simulation software to predict properties of natural gas and simulate gas processing operations. Use of softwares , Mbal, Petrel, Ecrin, Saphire, Eclipse e.t c

LEARNING OUTCOMES

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

1. Enumerate and describe at least five (5) programming languages and software that are useful in in petroleum engineering.
2. Select and use least two (2) appropriate software or programming methods and available input and output data in problem solving in order to make successful modification and improvement in specific situations.
3. Apply computer software packages in the design of at least two (2) geophysical and geological program and predict and automates oil and natural gas properties
4. Apply a computer programming language to develop at least two (2) correlations, software and basic simulators software packages in the design of at least two (2) drilling, work-over and production facilities.
5. Optimize oil and gas production using at least four (4) computer software packages;

SECOND SEMESTER 400L

IUITS 402 STUDENTS INDUSTRIAL WORK EXPERIENCE SCHEME- 6 CREDITS

Course Contents

On- the -job experience in industry chosen for practical working experience but not necessarily limited to the student's major (24 weeks from the end of the first semester at 400-Level to the beginning of the first semester of the following session. Thus, the second semester at 400-Level is spent in industry). Each student is expected to work in a programme related industry, research institute or regulatory agencies etc., for a period of 6 months under the guidance of an appropriate personnel in the establishment but supervised by an academic staff of the Department. On completion of the training, the student submits the completed Log book on the experience at the establishment., Also, there will be a comprehensive report covering the whole of the student's industrial training experiences on which a seminar will be presented to the Department for overall assessment.

Learning Outcomes

Students at the end of the Industrial Work Experience training are expected to

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

500 LEVEL FIRST SEMESTER WORK LOADS FOR STUDENTS

Course Code	Course Title	Unit	Status	Prerequisites	Contact Hours/Week			Total Week Load
					L	T	P	
GRE501	Engineering Management I	3	**Core**		2	1	-	3
PEE501	Research Project 1	3	**Core**		-	-	9	9
PEE511	Drilling Engineering III	3	**Core**	PEE342/ PEE 411	2	1	-	3
PEE581	Natural Gas Engineering and Processing	3	**Core**		2	1	-	3
PEE 531	Petroleum Economics: Oil Field Development	2	**Core**		2	1	-	3
PEE561	Reservoir Engineering III	3	**Core**	PEE 461, PEE 431	2	1	-	3
PEE 591	Engineering Analysis-Numerical methods	3	**Core**		2	1	-	3
PEE 593	Enhanced Recovery Processes	2	**Elective**		1	1	-	2
PEE505	Laboratory Practical's	1	**Core**				3	1
	1st Semester Total Credit Units	**23**						

500 Level Second Semester Work Load By Students								
GRE502	Engineering Management and Law	2	**Core**		2	1	-	2
PEE 502	Research Project 11	3	**Core**		-	-1	9	3
PEE 552	Industrial safety and Oil Pollution and Control	3	**Core**		2	1	-	3
PEE572	Petroleum Production Engineering III	3	**Core**	PEE 471/ PEE 571	2	1	-	3
PEE 592	Reservoir Modelling and Simulation	3	**Core**		2	1	-	3
PEE 594	Offshore Technology	2	**Core**		1	1	-	2
PEE 584	Petroleum Product Transport and Storage	2	**Core**		1	1	-	2
PEE 586	Process Technology	2	Elective		1	1	-	2
PEE 510	Multiphase Flow in Pipes	2	Elective		1	1	-	2
	2nd Semester Total Credit Units	**22**						
	Total Sessional Credit Units	**45**						

- 500L Students advised to take at least one elective course.

FIRST SEMESTER

GRE501: ENGINEERING MANAGEMENT I (3 CREDITS)

COURSE CONTENT:

The Management Environment - Formation of a company, sources of finance, money and credit. Insurance. National policies, GNP growth rate and prediction. Balance of payments. Legal liabilities under company law, legal and contractual obligations to employees and the public, contractual obligations.

Organizational Management – Principles of organization, span of control. Elements of organization. Types. Principles of management. Schools of thought. Management by objectives.

Financial Management - Accounting methods. Financial statement. Elements of costing. Cost planning and control. Budget and budgetary control. Cost reduction programmes. Depreciation accounting, valuation of assets.

Personnel Management – Selection, recruitment and training. Job evaluation. Merit rating. Incentive schemes. Trade unions and collective bargaining.

Industrial Psychology – Individual and Group behaviour. The learning processes. Motivation and Morale. Influence of the industrial Environment.

LEARNING OUTCOME

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

1. Define the management theories and organization structures highlighting merits and demerits
2. Solve at least two (2) problems associated with waste (non-value adding activities) using the concept of value engineering.
3. Apply the algorithm involved in Critical Path Analysis and Programme Evaluation and review Technique to real life shop floor job allocation.
4. Identify four (4) factors considered in factory layout and location and describe at least six (6) bottlenecks associated with inventory.
5. Apply at least two (2) techniques of linear programming, transportation analysis and queuing theory for the purpose of efficient resource allocation and methods for waste reduction and elimination of redundancy in engineering organizations.

PEE 511: DRILLING TECHNOGY III (3 CREDITS)

COURSE CONTENT:

Drilling parameters: choice of drilling program and drilling rig: mechanical parameters and their optimization – drilling bits; hydraulic parameters – mud viscosity, density, filtrate and bit nozzles. Directional Drilling: Uses of directional drilling: deviating tools; vertical profile, horizontal profile; deviation measurements.

Offshore Drilling: Underwater BOP stack, marine risers, underwater well head, floater stability; heave compensators.

LEARNING OUTCOME

On completion of the course the students should be able to

1. Discuss drilling process and two methods used for evaluating drilling performance
2. Outline at least three factors affecting bits tooth wear and penetration rate.
3. Highlight key areas in well control system and list at least four well head equipment, three fishing tools and their function.

4. Explain well cementing process and identify at least four cementing Equipment.
5. Enumerate Squeeze cementing process and application of Cement plug.
6. Design a Casing string.

PEE 505: LABORATORY PRACTICAL (3 CREDITS)

COURSE CONTENT:

Planimetry and reserves evaluation. Experimental studies of petroleum engineering problems in reservoir and natural gas engineering: sampling and pressure measurements, displacements, water flooding, thermal flooding experiments. Measurement of petrophysical and fluid properties.

LEARNING OUTCOME

On completion of the course the students should be able to

1. Perform experiment on Planimetry method of reserves evaluation.
2. Experimental studies of petroleum engineering problems in reservoir and natural gas engineering:
3. Sampling and pressure measurements,
4. Demonstrate displacements, water flooding, thermal flooding experiments. Measurement of petrophysical and fluid properties.

PEE531: PETROLEUM ECONOMICS: OIL FIELD DEVELOPMENT I (3 CREDITS)

COURSE CONTENT:

Decision methods and yardsticks. Petroleum evaluations. Introducing uncertainty in evaluation. Return on investment: interest and inflation. Discounted cash flow; average annual rate of return method, average book rate of return method. Hoskolds methods.

Applications of probability distributions, binomial and normal distribution are occurrences and services requirements. Multiple kinds of objects and economic outcomes.

Mineral deposits and resources. Appraisal of uncertain ventures; statistical appraisal method for several ventures. Value of additional information Gambler's ruin by successive losses. Decision Trees and Economic models: Analysis of a probability tree. Comparing alternatives: retaining partial working interest versus overriding royal interest. Evaluating acceptance of a farm-out. Stochastic decision trees, forecasting and planning. The structure of the petroleum industry; economic geography- impact of oil resources on the economy of oil producing countries; linear programming; refinery economics; oil concessions in Nigeria; government participation; the Nigeria petroleum labor market; marketing and sales calculations; investment analysis; risk analysis and probability; financing energy crisis.

LEARNING OUTCOME

On completion of the course the students should be able to

1. Enumerate decision methods and yardsticks for Petroleum evaluations
2. Analyze and Estimate return on investment: discounted cash flow, Hoskolds methods. interest and inflation.

3. Applications of probability distributions, binomial and normal distribution are occurrences and services requirements. Multiple kinds of objects and economic outcomes.
   Appraisal of uncertain ventures; statistical appraisal method for several ventures and risk analysis and probability
4. explain value of additional information Gambler's ruin by successive losses. Decision Trees and Economic models:
5. Identify oil concessions in Nigeria and extent of government participation; the Nigeria petroleum labor market; marketing and sales calculations; investment analysis

PEE 561: RESERVOIR ENGINEERING III (3 CREDITS)

COURSE CONTENT:

Oil Field development, Gas field development (Volumetric, water drive, gas-condensate reservoir); Introduction to secondary recovery and its division, different methods, mobility ratio, basic flooding networks used in industry, effect of mobility, sweep efficiency. Water source and its treatment, Water flooding calculations using different methods – spacing and row of the wells. Immiscible and miscible displacement processes. Water influx; steady-state; pseudo steady-state (Hurst); transient (Van Everdingen and Hurst). Coning of water and gas; effects of partial penetration. Secondary recovery; water injection sweep efficiency stiles methods, Dykstra-Parson's method.

LEARNING OUTCOME

On completion of the course the students should be able to

1. State at least five major areas in an Oil and Gas Field development plan. Explain using economics of the oil and gas reservoirs.
2. Define Natural water influx . List at least two water influx models (steady and unsteady state and evaluate problems on water influx.
3. Define immiscible displacement, Recovery Efficiencyy. Outline at least three Factors affecting it .and identify at least one type of Secondary recovery and Pressure maintenance method (Water flooding and Gas Injection).
4. Calculate fractional flow rate in oil/water or gas /water systems using and frontal advance equations and Welge graphical method
5. Discuss Coning and apply correlation to calculate critical rate and breakthrough time in both horizontal and vertical wells.

PEE 581: NATURAL GAS ENGINEERING AND PROCESSING (3 CREDITS)

COURSE CONTENT:

Composition of Natural gas. Flow of natural gas. Field compression. Static and flowing bottom hole pressures calculations. Distribution of natural gas; pipeline equations for distributions at high and low pressures. Modifications of old transmission lines; looping and paralleling. Storage capacity of pipelines. Gas flow measurements, Dynamic and volumetric meters. Critical inflow proffers. Water hydrocarbon system. Gas pressure regulation. Underground storage of natural system. Phase behavior of natural gas systems; retrograde phenomena in natural gas mixtures; binary mixtures. Vaporization – equilibrium constants. Bubble point and dew point determination. Field processing: flash calculation; stage separation. Water hydrocarbon system; water content, storm distillation, fractional distillation, binary distillation, multi-component distillation. Absorption and adsorption; removal of H_2S and CO_2 from natural gas. Gas plant design, LPG and LNG systems

LEARNING OUTCOMES

1. Identify and describe three (3) gas process separators, their sizing and become familiar with slug catchers and other separator types.
2. Describe gas dehydration and sweetening, refrigeration and fractionation, cryogenics and LNG processes of hydrocarbon recovery (NGL).
3. Explain phase behavior of natural gas and differentiate between gas reservoirs and calculate at least six (6) natural gas properties and optimizing natural gas production
4. Estimation of gas volumes and gas reserves using at least four (4) methods and determine flow of natural gas in porous media during at least three (3) states and flow regimes.
5. Determine the static and flowing bottom hole pressures of gas wells, using at least three (3)methods and gas reservoir deliverability test and choke performance problems in gas wells.
6. Describe gas gathering, transportation systems and solve at least four (4) pipeline network calculation problems and identify different types of gas flow meters and apply mathematical models to calculate gas flow rates.

PEE591: ENGINEERING ANALYSIS: NUMERICAL METHODS (3 CREDITS)

COURSE CONTENT:

Review of programming. Solution of Petroleum Engineering problems using computer. Interpolation with equal and unequal base points. Reading of capillary pressure, relative permeability graphs. Trial and error methods of computation: phase composition and mole fractions in separation processes, internal rate of return. The Newton-Raphson method. Numerical integration: Carpenter and Poettman equations. Systems of linear equations; direct and some interactive methods of solution. Solution of ordinary differential equations encountered in fluid flow in pipes boundary conditions.

LEARNING OUTCOME

On completion of the course the students should be able to

1. Enumerate solution of Petroleum Engineering problems using computer.
2. Analysis using Interpolation with equal and unequal base points and analyse capillary pressure, relative permeability graphs.
3. Computing using the Newton-Raphson method.
4. Calculations with Numerical integration: Carpenter and Poettman equations. Systems of linear equations; direct and some interactive methods of solution.
5. Identify methods of solution of ordinary differential equations and solve problems encountered in fluid flow in pipes boundary conditions.

PEE 593: ENHANCED RECOVERY PROCESSES (2 CREDITS)

COURSE CONTENT:

Principles of displacement: rock properties; fluid properties in reservoir; phase behavior; displacement efficiencies. Gas methods: miscible slug; enriched gas-high pressure lean gas; carbon dioxide; nitrogen and other inert. Chemical methods; micellar-polymers; polymer augmented water flood; permeability alteration; caustic. Thermal methods: steam stimulation, steam drive, in-situ combustion; foam injection; economic factors, cost of equipment and operation, risk, etc.

LEARNING OUTCOME

On completion of the course the students should be able to

1. State the relevance of additional oil recovery processes and the latest technology used.
2. Discuss the mechanism of fluid displacement and application of fractional flow equations in the reservoir and displacement efficiencies
3. **Identify** the various gases, chemicals, heat and other materials and understand how they can be utilized to displace oil.
4. Enumerate the criteria for the applications of EOR methods (reservoir and fluid specific)
5. **Explain** financial implications involved in an EOR project and its effect on man and the environment

PEE 501: RESEARCH PROJECT (3 CREDITS)

project work involving the design models, petroleum engineering software programming, lab experiment and testing, data collection and analysis and presentation of a comprehensive written report of the investigation

LEARNING OUTCOME

On completion of the course the students should be able to

1. Work on a project individually and as a team
2. Demonstrate skill in project writing and reporting
3. Literature search, citation and referencing
4. Gather data experiment, analyze. interpret and infer possible results
5. Presentation of project using software applications

SECOND SEMESTER

GRE 502: ENGINEERING MANAGEMENT II AND LAW (2 CREDITS)

COURSE CONTENT:

Resource Management: Materials management. Purchasing methods. Contracts. Stores and Inventory Control. Resource Utilization. Time value of money. Interest formulae. Rate of return. Methods of economic evaluation. Selection between alternatives. Planning Decision-making Forecasting, Planning, Scheduling. Production control. Gantt Chart, CPM. and PERT.

Optimization. Linear programming as an aid to decision-making. Elementary treatment of decision-making policies under risks and uncertainties.

Transport and Materials Handling Selection of transport media for finished goods, raw materials and equipment. Facility layout and location. Work study and production processes.
Basic principles of work study. Principles of motion economy. Ergonomics in the design of equipment and processes. Introduction to Computer Software used in Management.

LEARNING OUTCOME

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

1. Define the management theories and organization structures and apply the algorithm involved in Critical Path Analysis and Programme Evaluation and Review Technique to real life shop floor job allocation.
2. Identify four (4)factors considered in factory layout and location and describe at least six (6) bottlenecks associated with inventory.
3. Evaluate the performance of resources deployed in production/service systems, i.e., materials, machines, manpower.
4. Demonstrate at least one (1) practical approach on how to manage and combine resources efficiently using engineering management skills.
5. Apply at least two (2) techniques of linear programming, transportation analysis and queuing theory for the purpose of efficient resource allocation.

ENGINEERING LAW

COURSE CONTENT:

Common Law; Its history, definition, nature and division. Legislation Codification interpretation. Equity: definition and its main spheres. Law of contracts for Engineers: offer, acceptance communication termination. General principle of criminal law. Law of torts: definition, classification and liabilities. Patent: requirements, application and infringement. Company law. Labour law and Industrial law.

Learning Outcomes

Students will be able to:

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

PEE 552: INDUSTRIAL SAFETY AND OIL POLLUTION CONTROL (3 CREDITS)

COURSE CONTENT:

The operating environment; development of industrial safety, scope and magnitude of the problem; Safety regulations. Burning of gases. Mechanisms of flame propagation. Fire and explosion, limits of flammability. Toxicity and toxicology. Labeling and identification of hazardous materials, storage facilities industrial fire protection. Causes of oil pollution: blowout, pipeline and flow line leakages, sour gas production, sea transportation hazards. Need for oil spill prevention and control: Impact on the environment – ecology. Mechanical, chemical and biological Global pollution problems: Government regulations and contingency plans. Clean Nigerian/Association (CAN) and other interested bodies.

Learning Outcome

On completion of the course the students should be able to

1. Define pollution and state at least three types.
2. List at least three sources of oil pollution. Enumerate at least five causes of Oil Pollution.
3. Identify at least three impacts on the environment, ecology, humans.
4. Discuss at least three case studies of areas where oil pollution occurred in Nigeria.
5. Highlight the need for oil spill prevention and control.
6. State at least five equipment /tools used in the physical /mechanical methods.
7. List at least four chemicals used for oil pollution control.
8. Define bioremediation, bio stimulation and bioaugmentation with GEMs.
9. Discuss with at least two reasons why pollution is a Global problem.
10. Enumerate at least three Government regulations/method of preventing oil pollution.
11. Identify six organization that control pollution and enforce laws for compliance.

PEE 572: PETROLEUM PRODUCTION ENGINEERING III (3CREDITS)

COURSE CONTENT:

Problem-well analysis: Work over techniques; well stimulation; fracturing and acidizing. Sand control: gravel packing; sand consolidation. Pipelines and transportation; maximum pipeline capacity; other transportation systems. Metering of oil and gas; problems associated with flow measurement; flow measurement systems; liquid level controllers.

LEARNING OUTCOME

On completion of the course the students should be able to

1. Discuss Problem-well analysis:
2. Identify work over techniques;
3. Explain methods of well stimulation; fracturing and acidizing.
4. Discuss Sand control methods : gravel packing; sand consolidation.
5. enumerate Pipelines and transportation; maximum pipeline capacity; other transportation systems.
6. Appraise the concept of Metering of oil and gas;

7. State problems associated with flow measurement; flow measurement systems; liquid level controllers.

PEE 584: PETROLEUM PRODUCT TRANSPORT AND STORAGE (2 CREDITS)

COURSE CONTENT:

Transportation of crude oil; pipelines; tankers – loading and unloading techniques, offshore loading systems, international regulations on tanker transportation. Custody transfer storage of crude oil tank farm operations- gauging, sampling, quality control, underground storage- cavern, porous rocks. Gas transportation; compressors, pipelines; liquefied natural gas transportation. Storage of natural gas; pressure tanks, re-injection in porous rocks, storage in caverns. Storage of LNG.

LEARNING OUTCOME

At the end of the course students should be able to;

1. Discuss relevance of transportation and storage and identify at least three means of petroleum transport and method of storage.
2. Discuss loading and unloading techniques and offshore loading systems and demonstrate Gauging, sampling, and quality control.
3. Identify at least three screening criteria for the international regulations on tanker transportation and state what Custody transfer storage of crude oil tank farm entails. Enumerate Storage of natural gas in pressure tanks and re-injection in porous and LNG in caverns.
4. Outline global best practice in crude oil; pipelines; tankers, gauging, sampling and quality control.
5. examine the structure, construction, safety and protection of oil and gas storage and transportation facilities.

PEE 586: PROCESS TECHNOLOGY (2 CREDITS)

COURSE CONTENT:

Pressure losses in pipes. Pressure losses in armature and fittings. Pumps, Heat exchangers. Nozzle theory and mass transfer. Combustion processes. Heat transfer, Conduction; Convection; Condensation, Heat Exchangers. Distillation. Particle falls in liquid cyclones.

LEARNING OUTCOME

On completion of the course the students should be able to

1. Evaluate Pressure losses in pipes and identify pressure losses in armature and fittings, Pumps, Heat exchangers.
2. Discuss the key areas in Nozzle theory and mass transfer.
3. Analyze combustion processes. Heat transfer,
4. Discuss the processes of Conduction; Convection; Condensation, heat exchangers. Distillation. Particle falls in liquid cyclones.

PEE 592: RESERVOIR MODELING AND SIMULATION (3 CREDITS)

COURSE CONTENT:

Purpose of reservoir simulation. Concepts of Simulation; Darcy's law. Fluid in porous media. Reservoir simulation equations. Finite-difference model. Solution of the simulator equations. Matrix of simultaneous equations; Data preparation: fluid data, rock data, production data, flow rate data. Making a simulation study. History matching.

LEARNING OUTCOME

On completion of the course the students should be able to

1. Discuss Purpose of reservoir simulation.
2. Identify key areas in the concepts of Simulation; Darcy's law. Fluid in porous media
3. Solve Reservoir simulation equations, with example using Finite-difference model.
4. Enumerate solution of the simulator equations, Matrix of simultaneous equations;
5. Prepare Data: fluid data, rock data, production data, flow rate data. Making a simulation study.
6. Highlight key features of History matching

PEE 594: OFFSHORE OPERATIONS (3 CREDITS)

COURSE CONTENT:

Offshore drilling: Offshore prospecting; offshore rigs; stationary and floating rigs; rig movement and stability, drilling from a floating vessel; subsea BOP stack; marine risers; subsea wellhead. Offshore production; subsea well completion methods; offshore processing equipment and design; loading systems and other transportation. Offshore operations; logistics, contingency planning; oil spill and oil removal.

LEARNING OUTCOMES

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

1. Discuss offshore oil and gas exploration, drilling and production in Nigeria and challenges.
2. Describe at least five (5) features of offshore operational environment identify at least offshore rig and structures..
3. Describe the various offshore floating production units and operational safety measures and mooring systems, their configurations, components, advantages and disadvantages.
4. Outlines five (5) different types of risers, their applications, design criteria and failures.
5. Describe subsea completion system and state advantages of a subsea completion system and topsides facilities, offshore terminals, storage, pipelines, diving and remotely operated vehicle

PEE 510: MULTIPLE PHASE FLOW IN PIPES (2 CREDITS)

COURSE CONTENT:

Principles of two-phase flow; The general energy equation: Evaluation of friction losses. Single phase flow. Variables used in two phase flow; flow patterns. Horizontal flow: Horizontal pressure loss prediction methods. Prediction of horizontal flow patterns. Flow through restrictions. Flow assurance in multiphase flow.

LEARNING OUTCOME

On completion of the course the students should be able to;

1. Enumerate the relevance of multiphase flow in the petroleum industry Principles of Single and two-phase flow.
2. The general energy equation: Evaluation of friction losses.
3. Identify variables used in two phase flow; flow patterns. Horizontal flow: Horizontal pressure loss prediction methods. Prediction of horizontal flow patterns.
4. Evaluate and analyze of Flow through different restrictions.
5. Discuss key component of Flow assurance in multiphase flow.

PEE 502: RESEARCH PROJECT (3 CREDITS)

Course content

Concluding Project work involving the design models, petroleum engineering software programming, lab experiment and testing, data collection and analysis, and presentation of a comprehensive written report of the investigation.

LEARNING OUTCOME

On completion of the course the students should be able to

1. Work on a project individually and as a team
2. Demonstrate skill in project writing and reporting
3. Literature search, citation and referencing
4. Gather data experiment, analyze and interpret and infer possible results
5. Presentation of project using software applications

3.0 FINAL YEAR PROJECT AND THESIS

A project is an extremely important part of the engineering degree program me. Although lectures and laboratory experiments are designed to improve learning process, project supplements this process by starting the student on to the path of independent thinking. The student will be required to carry out independently a small project which would enable him to develop his thought processes, creativity, problem-solving ability, initiative, and attitude to work. The nature of the project may be one or more of the following:

(a) Developing a theory for solving a problem
(b) Check the feasibility
(c) Developing computational procedures for solving a problem
(d) Setting up an experiment for demonstrating an establishing theory.
(e) Building a working system form established plans and testing the system
(f) Developing a design routine for a device, constructing it (if required for the project) and testing it
(g) Investigating specific problems which may arise in governmental Institution, Industrial firms, and other private bodies of corporation in the country.
(h) Investigating causes of failure of any specific plant or device and suggesting remedies, if any.

Examination regulation stipulates that "project and thesis" would carry marks equivalent to two 2-hour paper in the final examination. For the purpose of marking, an oral examination will be held in which the student will be required to defend his project.

3.1. How to Select a Project:

A project should normally be chosen from fields related to the specific subject selected by the student for the final year degree examination. In selecting a topic for a project, it is expected that the student goes through the subject titles of papers (in the field of interest) published during the last ten years in engineering journals. Some of these journals are present in Appendix. A student, first of all go through the subject headings as listed in "Petroleum Engineering Abstracts" or "Applied Science and Technology Index". The specific journal in which the paper of interest is published is then consulted and all references listed in the paper collected. A likely project or problem if found the student discusses it with his lecturers who will instruct as to whether equipment could be made available for the project and whether any staff member would be willing to act as a supervisor. The student would then prepare a rough outline of the proposed project listing all references materials and submit it to the supervisor. The supervisor after establishing feasibility of the project, would give final go-ahead or possibly suggest something different, or modification in which the supervisor himself is interested. The ideal situation is one where the chosen project coincided with a supervisor's area of interest. For this reason, member of staff are requested to design projects in their areas of research interest. Students can then choose their project from a list of such project topics. Whenever practicable, students should know their projects long before the beginning of the session.

3.2 Basic precepts regarding Engineering Projects:

Two of the most important aspects of a project work include the preparation and organization. Preparation and organization are of the utmost importance in writing the report on the project if someone else is to understand the work. Preparation requires a careful reading of the instruction and collateral material (references, manuals etc.), a clear understanding of each step involving in the required procedures before the actual execution of the project, and often a written planned programme (rough outline of proposed, degree to be investigated, preliminary calculations, etc.).

Organization is a guiding principle to be followed throughout, then preparation, execution and reporting of a particular topic. A good organization, entails the neat construction or design of the model they may be easily visualized and checked, systematic entering of data with descriptive headings and entering of all relevant information regarding equipment used.

3.3. Writing of Thesis

A student should aim at his project at about the middle of the second semester, and submit the typed and bound copies of the project two weeks to the beginning of second semester examinations.

The time schedule should be roughly as follows:

Initial preparation .... 6 weeks
Practical Work connected with the project .... .10 weeks
Write-up and submission of draft Thesis .... 4 weeks
Supervisor's and comment on draft project......... 3 weeks
Typing, correction and binding of final thesis ..... 4 weeks

3.4 Organization of Thesis:

Before adopting a format for your project, it is necessary to read the information for author of any Engineering journal reference:

Menzel, Jones and Boyd: "Writing a Technical Paper", Mc Graw-Hill, 1961.

A formal report on a project may follow this outline and could include the following:

(a) Abstract: A concise description of the report including the purpose and most important result in the order in which they occur in the report paper.
(b) Introduction: a complete statement of the problem an outline of the theory involved in the solution, and a brief statement concerning the expected results.
(c) Body: of the report should include;
(d) Procedure: a brief outline of the actual constructional experimental, computational, or other methods followed including necessary circuit diagrams. Presentation of Result, an appropriate presentation of the original and processed data- lists, tables, graphs. Sample calculations must be shown.
(e) Conclusion, an interpretation of the results as they apply to the objectives of the project set out in the introduction. Any deviation from the expected or theoretical results are to be accounted for.
(f) Recommendations: any recommendations arising from the project work should be presented.
(g) Limitations of Work: some assumptions made to simplify the work are examined in the light of the results.

References: should be to commonly available publications and books. These should be listed at the end of the paper and number 1, 2, 3 etc. All reference should be referred to at least one in the text so as to justify their presence and relevance to the project. It is good practice to refer to a reference by its number (shown as superscript or subscript or written within parenthesis) in the text.

Appendices (if any) it is normal to set out construction details of a model, complex mathematical derivation of a theory, lengthy computation procedures etc., in appendices. They should be referred to in the text to justify their inclusion.

3.5. Binding and Number of Copies Required:

A minimum of four copies of the project is required, after typing the top copy (for the Department) and one other copy (for interview panel), the copies should be handed over to the Department after Binding. The student should bind the remaining two copies (at his own expense) one of which should be handed over to the supervisor.

3.6. Organization and Display of the Project Work:

Proper organization of a project work may be achieved by making reference to the following publications:

Wilson, E. B. "An introduction to Scientific Research" McGraw-Hill, 1952.

Baird, D.C.: "Experimentation: An Introduction to measurement Theory and Experiment Design" Prentice hall,1962.The student should normally display the essentials (short theory, models, input data, desired results, etc.) of a project and talk about or demonstrate them to visitors, or discuss his/ her project in a seminar held during the session. Display materials should therefore be prepared and preserved until the day of the oral examination. These should prove invaluable in explaining the project work to the members of the examination panel or to the external examiner.

3.7 Project and Thesis Assessment:

Your supervisor is the only other person who perhaps knows as much as you with respect to the problem involved in your project. Therefore, his opinion about you will count most in assessing your work. In giving his opinion, he should probably consider the following:

(a) The level of supervision or guidance he has been able to give you;

(b) The level of achievement you attain during the project with or without his guidance;

(c) Your ability to solve the problem posed by the project and how much of his was through your own effort;

(d) Whether you kept a day-to-day record (in the log-book) of the progress made and whether you discussed with him from time to time any problems you been confronted with. The supervisor's marking of the project will be to the extent of 30%, another 30% being allocated to the panel for the oral Examination while, 40% is to the external examiner. The members will assess you on the following:

(a) Your understanding of the subject you investigated

(b) Your ability to answer questions (and explain points) on the work you have done.

(c) Your presentation and layout.

(d) You may further be interviewed by the external examiner, or whenever a review of the grading by the supervisor and the panel become necessary

4.0 BECOMING A CHARTERED ENGINEER

To become a fully qualified professional engineer, graduates must be registered by the Council for the Regulation of Engineering in Nigeria (COREN). They can then use the letters C.Eng. after their names, indicating that they are a Chartered Engineers. The requirements are: an enhanced degree, i.e., a B.Eng. and a minimum of two years' approved industrial training with an appropriate company. The national youth service year is often counted as one if spent with an appropriate engineering enterprise. Thus, via a conventional four-year degree course, the process normally takes at least eight years from leaving school (see diagram); it may take longer, of course, if industrial training is difficult to come by. The provision of such training can be expensive for employers, because they will incur costs in providing it, and will lose the use of an employee's services whilst training is undertaken. The five-year thick sandwich course in the College of Engineering Technology at Igbinedion University, Okada helps to smooth the way through this stage, because the integrated industrial placement is approved by the Council for the Regulation of Engineering in Nigeria (COREN). With a large proportion of the industrial training already completed, students are well down the road to registration even before graduation.

5.0 **STAFF**

5.1 LIST OF ACADEMIC STAFF

S/N	NAME	QUALIFICATIONS	RANK/STATUS	Area of Specialization
1	Engr. Dr. Mrs. Elohor D. Akpobi	1. Ph.D. 2018 (Petroleum Eng), UNIBEN 2. M.ENG 2011 (Petroleum Eng), UNIBEN	Senior Lecturer/ Ag.HOD/fulltime	Reservoir Engineering/ /Enhanced Oil Recovery/Well Testing and

		3. B.Eng. 2003 (Petroleum Eng), UNIBEN, MSPE COREN **(R. 45,058**)		Analysis
2	Engr Prof. O. Olalekan Olafuyi	1. Ph.D. 2008 (Petroleum Engineering), Australia 2. M.ENG (Uni of Ibadan) (Petroleum Engineering),2000 3. B.ENG (Uni of Ibadan) (Petroleum Engineering)1997 4. COREN (**R.18, 236)**	Professor/Adjunct	Reservoir Engineering/ Production Engineering
3	Engr. Prof. Peter Akpoturi	Ph.D. 2013(Petroleum Eng), FUTO M.Eng. 2005 (Petroleum Eng), FUTO M.SC 2007(Envi. Science and Geography), DELSU B.Eng. 1998 (Petroleum Eng), FUTO COREN **(R. 40170**)	Professor (Sabbatical)	Drilling Engineering/ EOR
4	Dr Abubarkar Umar	Ph.D. 2019 (Petroleum Eng), Universiti Teknologi Petronas, Malaysia M.SC. 2014 (Petroleum Eng), Universiti Teknologi Petronas, Malaysia B.Eng 2008 (Petroleum Engineeing) Abubarkar Tafawa Balewa University Bauchi	Senior Lecturer/Adjunct	Reservoir Engineering Enhanced Oil Recovery
5	Engr. Dr. Onaiwu David Oduwa.	PhD,(Petroleum Eng) (UNIPORT) 2017 M.Eng. (Petroleum Eng) (UNIBEN), 2012 B.Eng. (Petroleum Eng) (UNIBEN), 2006 MSPE, MNSE, (COREN R.**5453**4)	Senior Lecturer/Adjunct	Drilling / Well Engineering

6	Engr. Dr. Yerima Yakubu	PhD, 2023, Chemical Engineering IUO M.Eng 2008, Chemical Engineering ABU Zaria B.Eng., 1992 Chemical Engineering ABU, MSPE, MNSE, COREN (R.31,316)	Senior Lecturer /F/T	Refinery processes. Fluid flow Thermodynamics /Renewable Energy
7	Engr. Mrs Perpetual Obeta	B.Eng. (Petroleum Eng) (FUTO), M.Eng. (Petroleum Eng) (UNIBEN) MSPE, MNSE, (COREN R.**36243**)	Lecturer I/Full-Time	Drilling Engineering /Renewable Energy Petroleum Production systems
8	Engr. Dr, Azuuokwu Augustine Azubike	PhD. 2024 (Petroleum Engineering) IUO. M.Eng. 2009(Petroleum Eng), FUTO B.Eng. 1998(Petroleum Eng), FUTO MSPE.,MNSE COREN (R**49561**)	Lecturer 1 /Full-Time	/Natural Gas Engineering/ /Reservoir Simulation / Petroleum Production systems
9	Engr. Opute Randolph Deh	B.Eng. 2006(Petroleum Eng),UNIBEN M.Eng. 2012 (Petroleum Eng), UNIBEN MNSE, COREN(**R.29963**)	Lecturer II/Full-Time	Petroleum Economics /Oil and Gas Field Development
10	Johnson Johnson Orene	B.Eng. 2006(Petroleum Eng),Niger Delta University Bayelsa M.Eng. 2012 (Petroleum Eng), UNIBEN, MSPE, MNSE	Lecturer II/Full-Time	Drilling Engineering/ Oil Pollution and Control / Reservoir Engineering

5.3 LIST OF TECHNICAL STAFF

S/N	NAME OF STAFF	QUALIFICATIONS	RANK
1	Mr. Gabriel O. Nwabah	B.Eng. 2004(Petroleum Eng), UNIBEN HND. 1997(Petroleum Eng), Petroleum Training Institute, Delta State MSPE	Asst Chief Technologist /Fulltime
2	Engr. Oteri Vincent O	M.Eng. 2014(Petroleum Eng), UNIBEN B.Eng. 2007(Petroleum Eng), UNIBEN **COREN R72210**	Senior Technologist/Part Time
3	**Engr. Neminebor Gift Pepe**	B.Eng. 2019(Petroleum Eng), Fed. Uni. of Petrol. Resources, Effurun, Delta State HND 2002 ,PTI, DELTA STATE **COREN R71080**	Technologist/Part Time
4	Mr. Fabian Omofuma	HND,2007, (Polymer Chemistry)FED POLY ,AUCHI 2. PGD, IUO,2017 (Industrial Chemistry)	Principal Technologist /Full time

5.3 LIST OF ADMINISTRATIVE STAFF

S/N	Name of Staff	Rank/Designation,	Qualification and Dates Obtained
1	Prof .R. U Azike	Dean	1. Ph.D. 2016 (Chemical Engineering), UNIBEN 2. M.ENG 2006 (Chemical Engineering), UNIBEN 3. PGD 2001 (Chemical Engineering), UNIBEN 4.B.SC (Biochemistry) 1997 R. R66468
2	Engr. Dr. Mrs. E.D. Akpobi	Ag. HOD	1. Ph.D. 2018 (Petroleum Eng), UNIBEN 2. M.ENG 2011 (Petroleum Eng), UNIBEN 3. B.Eng. 2003 (Petroleum Eng), UNIBEN COREN (R. 45,058)
3	Miss Jennifer Ijesurobo		1. B.Sc.2007 (Sociology and Anthropology) UNIBEN.

		Admin. Officer	2. PGD 2020 (Public Administration) IUO
4	Mrs. Ikponmwosa Angela	Senior Typist	ND (Edo State Institute of Technology and Management), 2010. B.Sc. (Igbinedion University, ,Business Admin) 2017
5	Mrs. Esther	Cleaner	F.S.L.C ()
6	Mrs Joy	Cleaner	F.S.L.C ()

LIST OF SOME PETROLEUM ENGINEERING BOOKS

1. Drilling Engineering Problems and Solutions A Field Guide for Engineers and Students M. E. Hossain and M. R. Islam (2018) Scrivener Publishing LLC
2. Reservoir Engineering Fundamentals and Applications Okotie Sylvester, Bibobra Ikporo (2019) Springer
3. Petroleum Production System Micheal J. Economides, Daniel hill. 2nd edition, 2012
4. Introduction to Petroleum Engineering John R. Fanchi. Richard Christensen(2017) WILEY publishers
5. Well Test Design and Analysis John Stewart, Pennwell Publishing (2011)
6. Modern Well Test Analysis-A Computer Aided approach Roland Horne
7. Fundamentals of Applied Reservoir Engineering- Appraisal, Economics, and Optimization Richard Wheaton (2016) Gulf publishing
8. Gas Well Testing Handbook Amanat U. Chaudry (2003) Elsevier
9. Fundamentals of Drilling Engineering Robert F. Mitchell, Stefan. Miska (2011) SPE Textbook Series
10. Applied Petroleum Reservoir Engineering Ronald Terry, J. Bradon Rogers (2015) Pearson Education. 3rd edition
11. Unconventional Reservoir: Rate and Pressure transient Analysis Techniques, Amin Taghavinejad Mehdi Ostadhassan Reza Denshfar, Springer Nature Switzerland AG, 2021
12. Enhanced Oil Recovery, Don W. Green G. Paul Willhite, Society Of Petroleum Engineers, 2nd Edition, 2018
13. Advanced Petroleum Reservoir Simulation, M. R. Islam M.E. Hossain S. Hossein Mousavizadegan Shabbir Mustahfiz Jamal H. Abou-Kassem, Scrivener Publishing, 2nd Edition, 2016
14. Advanced Well Completion Engineering, Wen Renpu, Gulf Professional Publishing, 3rd Edition, 2011
15. Corrosion in System for Storage and Transportation of Petroleum Product in Biofuel (Identification, Monitoring and Solutions), Alec Groysman, Springer, 2014
16. Advanced Oil well Drilling Engineering, Dr. Bill Mitchel, Mitchel Engineering, 10th Edition, 1995
17. Fluid Phase Behavior for Conventional Oil and Gas Reservoir, Alireza Bahadori, Gulf Professional Publishing, 2017
18. Reservoir Surveillance. Jitendra Kikan, 2013 SPE
19. Applied Well Cementing Engineering, Gefei Liu, Gulf Professional Publishing, 2021
20. Fundamentals of Reservoir Engineering (Fluid & Rock Properties), Dr. Isam M. s. Najar
21. Hameed Mahmood Salih, Dar Noon Publications and distribution, 2021
22. Corrosion Protection for Oil and Gas Industry (Pipelines, Subsea Equipment, and Structures), Mavis Sika Okyere, CRC Press (Taylor & Francis Group), 2019
23. Deepwater Drilling (Well Planning, Design, Engineering, Operation and Technology Application), Peter Aird, Gulf professional Publishing, 2019
24. Lost Circulation and Wellbore Strengthening, Yongcun Feng K. E. Gray, Springer Imprint, 2018

25. Renewables. David Elliot (2020) 2nd Edition IOP Publishing Bristol, UK
26. Modern Pressure Transient Analysis of Petroleum Reservoirs A Practical View. Tarek Al-Arbi Omar Ganat (2023) Springer Nature
27. Surfactants from Renewable Raw Materials. Divya Bajpai Tripathy, Anjali Gupta, Arvind Kumar Jain, Anuradha Mishra, (2022) CRC Publishing
28. Fundamentals of Sustainable Drilling Engineering. M. Enamul Hossain, Abdulaziz Abdullah Al-Majed, 2015 Scrivener publishing
29. Solved Problems in Well Testing -Quantitative Geology. Iraj Ershaghi 2023 Springer Nature