ELIZADE UNIVERSITY
ILARA–MOKIN, ONDO STATE

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Handbook for Undergraduate Programme

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Note: The Information contained in this handbook is accurate and up-to-date at the time of publication. However, the matters covered are subject to change from time to time. The Department will publish such changes, if there are any, in the next edition of the handbook.

Prof. Olukayode Amund, PhD, FAS
VICE-CHANCELLOR

Engr. Prof. O.A. Adeleke, PhD
Dean, Faculty of Engineering

Engr. Dr. Olugbenga Kayode Ogidan, DTech
Head, Department of Electrical & Electronics Engineering

Preface

The Departmental Handbook provides information to prospective students and registered students on programme of studies offered by the Department of Electrical and Electronics Engineering, Elizade University, Ilara – Mokin, Ondo State, Nigeria. It is hoped that the information would assist students to derive maximum advantages from the opportunities and facilities available in the Department and the University in planning their academic programmes.

The five-year engineering degree programme is built on a common foundation of basic studies, comprising Mathematics, Basic Sciences, Engineering Sciences and General Studies. The programme is designed to facilitate specialization while allowing opportunities for taking approved courses from other areas. The programme is also fashioned to allow the prospective graduate engineer to have appropriate technical expertise and human perspective.

The Department of Electrical and Electronics Engineering, Elizade University, Ilara – Mokin, Ondo State, Nigeria issues this Handbook as a general guide to its courses and facilities. It forms no part of a contract. The Department reserves the right to modify or alter without prior notice any of the contents herein.

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PRINCIPAL OFFICERS OF THE UNIVERSITY

VISITOR/FOUNDER
Chief Michael Ade-Ojo, OON
B.A. (UNN.)

CHAIRMAN, BOARD OF TRUSTEES
Chief Michael Ade-Ojo, OON
B.A. (UNN.)

CHANCELLOR
Dr. Gbenga Oyebode, MFR
LL.B (Ife), LL.M (Pennsylvania)

PRO-CHANCELLOR AND CHAIRMAN OF COUNCIL
Professor Femi Bamiro, CON
B.ENG. (Nottingham), Ph.D (McGill)

VICE-CHANCELLOR
Distinguished Professor O. O. Amund
B.Sc. (Lagos), Ph.D. (Cranfield)

REGISTRAR
Mr. Omololu Adegbenro
B.A. (Ado), MCA (Ibadan), PGD (Lagos)

UNIVERSITY BURSAR
Mr. Samuel Ajeigbe
FCA, MBA, ACTI

UNIVERSITY LIBRARIAN
Dr. Christopher Nkiko
B.Sc (Benin), M.Sc, MLS, Ph.D (Ibadan), CLN

The University's Mission

To produce graduates with the appropriate skills and knowledge for the development of the nation and global competitiveness.

The University's Vision

Elizade University seeks to be a globally competitive institution that produces entrepreneurial, innovative and ethical graduates.

The University's Strategic Objectives

The strategic objectives of the University (Elizade University, Ilara- Mokin) are to:

a. produce graduates of international standard, with appropriate knowledge and skills in their field of study, who will be highly employable and to employ themselves;
b. provide high quality research and development activities that will promote the development of the Nation and enhance the image of the University and the researchers;
c. harness modern technology especially ICT and modern social, economic and financial strategies to run a cost of efficient and effective academic programme and institutional management;
d. provide services that have relevance to and impact on the local community and the Nation;
e. provide conditions of study, work and living in the University Community that are of appropriate standard;
f. expand access to tertiary education in the face of unmet demand; and

g. operate as an equal opportunity educational institution, sensitive to the principle of gender equity and non-discriminatory based on race, ethnicity, religion or physical disability.

Roll of Honours for Students

Senate decided that Roll of Honours for Students be instituted in the University to enhance discipline and good performance among students. All students are enjoined to strive to be on the Honours Roll.

The Details of the honours roll are as follows:

The Honours Roll should be at three levels as follows:

a. Founder list: for suitably qualified candidate with a minimum CGPA of 4.75 on a basis of 5.00.
b. VC list: for suitably qualified candidate with a minimum CGPA of 4.5 on a basis of 5.00, and
c. Dean's list: for suitably qualified candidate with a minimum CGPA of 4.00 on a basis of 5.00

The beneficiaries must have a minimum CGPA of 4.0 out of 5.00 and the beneficiary must maintain this grade annually to continue to enjoy the award. The recommendations must be processed along with results of second Semester Examinations. Student must be of good conduct. He or she must not have outstanding or carry-over courses and must not be repeating the year. No student on Leave of Absence shall enjoy the Annual Roll of Honours Award. No student that has a disciplinary problem shall enjoy the award. The award shall be based on the recommendation of the Department's Board of Examiners and the Faculty Board of Examiners. Each beneficiary shall be given a certificate.

Information on Division of Students' Affairs

Information on students' welfare can be summarized as follows:

a. **Guidance and Counselling Unit:** The Division of Student Affairs has Professional Counsellors who are committed to helping students grow in self-understanding in the Process of integrating their personal and academic experiences. The Services are free to students and are confidential (not used as part of his/her other University records). The services include personal Counselling, group counselling, study skills improvement, tests anxiety reduction, personal crisis intervention, psychological testing, career and occupational counselling and settlement of grievances between students, where necessary, consultations are made with campus organizations, sound academic Departments, to ensure that students' problems are resolved satisfactorily. The Counsellors can be contacted on the ground floor of the Senate Building;
b. **Scholarship and Financial Assistance:** The Division of Students' Affairs serves as a link between students and Sponsoring authorities, both within and outside Nigeria. Students are to check the Notice Boards in their respective faculties as well as those at the Division of Student Affairs Building for advertisements and other relevant information. Liaison is also maintained between students and governments at various **l**evels for scholarship and bursaries.

Information on the University Library

Membership of the Library is available, on completion of a registration card, to all students, members of the senior staff of the University and such other persons as may be determined by the Library Committee or the University Librarian on behalf of it. Students are required to renew their registration at the beginning of each academic year. Library Cards and Borrower's Tickets are not transferable; books issued on them remain the responsibility of the person whose name appears on them. A Lost Library Card or Borrower's Ticket may be replaced on submission of a written application.

History and Location of the University and the Programme

The Elizade University is located in lIara-Mokin in Ondo State of Nigeria. The State was created on 3 February 1976 from the former Western State. It originally included what is now Ekiti State, which was carved out of Ondo State in 1996. Akure is the State capital. The State lies between Longitudes 4° 30' and 6' East of the Greenwich Meridian, 5° 45' and 8° 15' North of the Equator. This means that the State lies' entirely in the tropics. Ondo State is bounded in the North by Ekiti and Kogi States; in the East by Edo State; in the West by Oyo and Ogun States; and in the South by the Atlantic Ocean. The State has a land area of 14,788.723 Square Kilometres. The State has a population of 3,441,024 comprising 1,761,263 males and 1,679,761 females.

The Elizade University emphasizes learning, research and development. Having completed all due processes, approval for the establishment of the Elizade University was given by the Federal Government on 22 February 2012. The approval was conveyed vide the Provisional Licence to Operate as a Private

University No. 46 dated 28 February 2012 issued by the National Universities Commission. The Elizade University aims to attract the best and the brightest students in Nigeria and beyond. The main aim is to provide them with practical-oriented scientific, technological and arts education which shall make them self-reliant while preparing them for future leadership and success in their chosen careers in the highly competitive new knowledge society. Academic session of the Elizade University started at 2012/ 2013 session (6th January 2013). The Engineering Faculty started at the Elizade University during 2013 / 2014 academic session (September).

The Department of Electrical and Electronics Engineering commenced academic activities at the beginning of 2013/2014 Academic Session as one of the pioneer departments in the Faculty of Engineering. The total students' enrolment rose from 17 in the first year to the current figure of 55 students' enrolment (100 to 500 level) on its Bachelor of Engineering (Electrical and Electronics Engineering programme).

STAFFING

i. Academic Staff

Names	Rank	Qualifications	Research Area
Engr. Dr. Olugbenga Kayode OGIDAN	Senior Lecturer/ Ag. HOD	B.Eng. (Ado Ekiti), M.Eng. (Akure), D.Tech. (Cape Town), COREN Regd. (R20748), MCPN (No. 002815/2010), MInst.P. (No.4621).	Systems Automation and Control, Real-time and Embedded systems, Internet of Things
Engr. Prof. Oluseye Adeniyi ADELEKE	Professor	B. Tech, M.Tech (LAUTECH) PhD (Malaysia), COREN Regd. (R.19857), MNSE, MIEEE.	Wireless Communication, Game-Theoretic modelling, Cooperative Communication, Energy Scavenging for Sensor networks.
Engr. Dr. Folasade M. Dahunsi	Reader (Associate)	B.Eng. (Ilorin), M.Eng. (Bauchi), PhD. (Johannesburg), COREN Regd. (R25180)	Performance evaluation of telecommunication networks, smart systems, computational/ artificial intelligence analysis and modelling, big data analysis, and innovative ICT solutions for development

Names	Rank	Qualifications	Research Area
Engr. Dr. Kehinde Olusesan TEMIKOTAN	Lecturer I	B.Sc (Ife), PGD, M.Eng. MBA, PhD (FUTA) COREN Regd. (R. 6504), FNSE (07270), FNIEEE, SMIEEE	Power Systems Automation, Smart Grid
Engr Ola Austin OSHIN	Lecturer II	B.Engr (FUTA). M.Engr. (FUTA,) (NSE Regd. R43363, COREN- Regd. R42603	Electric Power Generation, Power Distribution Systems; Power and Machines and Hybrid Electric Power System
Engr Moses Oluwamuyiwa OLLA	Lecturer II	B.Eng., M.Eng. (EKSU), COREN Regd.,	Wireless Communication Systems, Internet of Things (IoT), Computational Electromagnetics
Engr Celestine AGHAUKWU	Lecturer II	HND (Auchi), B.ENG (Uniport) M.Tech (RSUST) COREN: R57266, IEEE: 98276104	Power Electronics And industrial application, Renewable Energy.

Names	Rank	Qualifications	Research Area
Engr. Dr. A. P. OKEDIJI	Senior Lecturer (Associate)	B.Sc Hons. M.Tech. PhD MNSE, COREN Regd. (R38218)	Thermofluid and Renewable Energy
Engr. Dr. H. A. AJIMOTOKAN	Senior Lecturer (Associate)	B.Tech. M.Sc; PhD COREN Regd. (R16902)	Renewable Energy and Systems material energy efficiency

NON-ACADEMIC STAFF: FACULTY OF ENGINEERING

TECHNICAL STAFF			
Mr Kabir Adio LASISI	Principal Technologist	HND Electrical Engineering (Power and Machine Option), Kaduna Polytechnic, Kaduna 2004 ND Electrical Engineering, Federal Polytechnic, Bida,2001	Power and Machines
Engr. A.B TEMITOPE	Senior Technologist	HND, Electrical/Electronic Engineering COREN	Instrumentation and Control
Engr. OLADUNNI GBENGA. A	Senior Technologist	HND, Electrical/Electronic Engineering COREN	Renewable Energy
Mr. Michael Tuyi OMOLE	Technologist 1	HND Electrical/Electronic Engineering REGD: NATE (C-12101)	Electrical/Electronics Engineering

ADMINISTRATIVE SUPPORT

Table 3.3: Administrative Non –teaching Staff Disposition in the Department

Name of Staff	Rank/Designation	Qualification and Dates Obtained	Duties
Miss Dorcas AKANJI	Confidential Secretary	HND Office Technology and Management (Ilaro, 2019)	Secretarial Administration and Office Management
Mr.Tosin ORIMOLADE	Clerical Officer	NCE Economics/Mathematics	Clerical duties

The Course Unit System and Computation of Cumulative Grade Point Average [CGPA].

The course units in the Department are organized on the course credit system per semester. A semester lasts for approximately 17 weeks, including the periods of registration and examinations provided that not less than 14 weeks are devoted to actual teaching (Appendix A). One credit unit is the equivalent of 15 contact hours of classroom teaching or 30 hours of laboratory work. Most of the course units in the Department carry the weight of 2 or 3 credit units, suggesting that they are taught for 30 or 45 hours in the semester or 2 or 3 one-hour periods per week. In courses with strong practical component, this means that there are 15 hours of teaching and 45 hours of practicals to qualify for 2 credit units or 30 hours of teaching and 45 hours of practical for 3 credit unit courses. However, there are fewer 3 credit unit courses which suggest that more work is required to be done in 45 contact hours per semester or the equivalent in terms of practical and classroom teaching. At the end of each semester, a final examination is given to bring the course to final conclusion. The final examination in each course unit is weighted 60% of the component. No student can pass in a course unit if he/she fails to submit the continuous assessment (CA) assignments.

Pattern of Examination

Each course shall be examined at the end of the course. The examination shall be conducted as prescribed by Senate. Each examination shall be 1-3 hours in duration. In addition, there

may be a practical paper and/or an oral examination. There shall be continuous assessment of each course and this shall constitute a percentage of the formal grade.

Measurement of Performance

Performance in a course shall be measured in terms of:

a. The results of prescribed theory and practical examination;
b. Continuous assessment which shall constitute 40% of measured performance; and
c. Assessment of such essay, practical exercises and reports prescribed for each course.

Level of Performance

A student shall be recorded as having attained in a course a level of achievement graded as follows:

Level of Performance	Rating	Credit Points per Unit
A	70% - 100%	5 (Excellent)
B	60% - 69%	4 (Very Good)
C	50% - 59%	3 (Good)
D	45% - 49%	2 (Satisfactory)
E	40% - 44%	1 (Adequate)
F	0% - 39%	0 (Failure)

Calculation of Grade Point Average [GPA]

The overall performance of each candidate during an entire semester shall be determined by means of a weighted grade point average, obtained by awarding credit points in respect of each course multiplied by the numeral value of the grade obtained as follows:

Level of Performance	Rating	Credit Points per Unit
A	70% - 100%	5
B	60% - 69%	4
C	50% - 59%	3
D	45% - 49%	2
E	40% - 44%	1
F	0% - 39%	0

Definition of Term.

a. **Student Workload:** This is defined in terms of course units. One unit represents one hour of lecture or one hour of Tutorial or 2-4 hours of practical work per week throughout a semester. Thus, for example, a course in which there are 2 hours of lectures and 1hour of Tutorial per week is a 3-unit course.

b. **Total Number of Units (TNU):** This is the total number of course units carried by a student in a particular semester. It is the summation of the load Units on all courses carried during the semester. For example, a student who is carrying 6 courses of 3 units each has a TNU of 18 for that semester. No student shall be allowed to carry (i.e. register for) or be examined in more than 24 units in any particular semester.

c. **Cumulative Number of Units (CNU):** This is the summation of total number of Units over all the semesters from the beginning to date. A student who is prone to repeating courses will finish (if he does not drop out) with a higher CNU than his non-repeating colleagues and will most likely require a longer time to complete requirements for the award of Degrees.

d. Level of Performance Rating: This is the rating of grades obtained in terms of Credit points per load unit. The rating used is as follows:

Level of Performance	Rating	Credit Points per Unit
A	70% - 100%	5
B	60% - 69%	4
C	50% - 59%	3
D	45% - 49%	2
E	40% - 44%	1
F	0% - 39%	0

Based on the above, a student who obtained a grade of "A" in a 4-unit course has scored 20 Credit points, and one who obtained a grade of C in that course has scored 12 Credit points.

e. Total Credit Point (TCP): This is the sum of the products of the course units and rating in each course, for the entire semester period. For example, consider a student who took 4 courses of 5 units each. Let's say the grade obtained in the four courses were C.B.E.D. respectively. The TCP of this student is obtained as 5 x 3 + 5 x 4 + 5 x 1 + 5 x 2 = 50

f. Cumulative Credit Point (CCP): This is the summation of Total Credit Points over all semesters from beginning to date.

g. Grade Point Average (GPA): This is the total credit points (TCP) divided by the total units (TNU). For example, consider the student's scores referred to above. His TCP is 45, and of course, his TNU is 20 (4 courses at 5 units each, for the semester). The highest GPA that can be earned is 5.0 and that is when a student has earned a grade of "A" in every course during the semester. The

lowest GPA obtainable is 0.0 and this would happen if the student has F all round during the semester

h. Cumulative Grade Point Average (CGPA): This is the summation of TCPs for all semesters, divided by the summation of TNU s for the said semesters. Like the GPA, CGPA obtained ranges from 0 to 5.

GPA and CGPA Sample Computations

Sample Computations: Consider a student who has enrolled for his/ her 100level courses, and has just completed 2 full semesters in the University, His/Her GPA and CGPA could be computed as follows (Table 1).

Table 1a: Example of CGPA Computation for First Semester

100-LEVEL: 1ST SEMESTER										
Course Code	**Course Title**	**Units**	**Lecture**	**Tutorial**	**Practical**	**Examination Score**	**Rating**	**CP**	**TCP**	**TNU**
GST 101	Use of English I	2	1	1	-	75 (A)	5	10	10	2
GST 103	Use of Library and Information Literacy	1	1	-	-	35 (F)	0	0	10	3
GST 105	Citizenship and Leadership Education	1	2	-	-	60 (B)	4	4	14	4
MTH 101	General Mathematics I	3	2	1	-	87(A)	5	15	29	7
MTH 103	General Mathematics III	3	2	1	-	67(B)	4	12	41	10
PHY 101	General Physics I	3	2	-	3	78(A)	5	15	56	13
CHM 101	General Chemistry I	3	2	1	-	45 (D)	2	6	62	16

100-LEVEL: 1ST SEMESTER										
Course Code	**Course Title**	**Units**	**Lecture**	**Tutorial**	**Practical**	**Examination Score**	**Rating**	**CP**	**TCP**	**TNU**
CSC 101	Introduction to Computer Science I	3	2	-	3	88(A)	5	15	77	19
						Previous		Current		
						GPA	0	GPA	4.05	
						CGPA	0	CGPA	4.05	

Table 1b: Example of CGPA Computation for Second Semester

100-LEVEL: 2ND SEMESTER										
Course Code	Course Title	Units	Lecture	Tutorial	Practical	Examination Score	Rating	CP	TCP	TNU
GST 102	Use of English II	2	1	1	-	75 (A)	5	10	10	2
GST 104	History And Philosophy of Science and Technology	1	1	-	-	75 (A)	5	5	15	3
GST 106	Philosophy and Logic	2	2	-	-	60 (B)	4	8	23	5
MTH 102	General Mathematics II (Calculus)	3	2	1	-	87(A)	5	15	38	8
PHY 102	General Physics II	3	2	1	-	88(A)	5	15	53	11
CHM 102	General Chemistry I	3	2	1	-	67(B)	4	12	65	14

100-LEVEL: 2ND SEMESTER										
Course Code	Course Title	Units	Lecture	Tutorial	Practical	Examination Score	Rating	CP	TCP	TNU
PHY 106	Properties of Matter	1	1	-	-			0	65	15
CSC 102	Introduction to Computer Science II	3	2	-	3	78(A)	5	15	80	18
GNE 102	Engineer –in– Society	1	1	-	-	45 (D	2	2	82	19
						Previous		Current		
Total		19				GPA	4.05	GPA	4.32	
						CGPA	4.05	CGPA	4.18	

Transfer within the University and Length of Stay in the University

For a student to qualify for a degree, a candidate will normally be required to spend a minimum of three academic years at the Elizade University. If a student transfers from one Faculty to another, the transfer would be treated as if he/she is just being admitted into the University since as part of the requirement for graduation the student has to take all the foundation/compulsory courses in the new Faculty or Department. In that case, his/her stay in the new Faculty or Department should be 1.5 times the number of semesters required to complete a programme. Where student transfers from a science-based Faculty to another, the computation of his result in the new Faculty shall take cognizance of his previous CGPA in the new Department. The duration of the stay in the University will be what remains of the 1.5 times the number of semesters required to complete the programme as approved by Senate.

Where a student is transferring from an engineering or a science-based to a Humanities, Arts-based Faculty or vice-versa, the transfer should be treated as if the student is just being admitted into the University. The GPA of the student will not be transferred to the new Department. He or She will however be required to take all the foundation or compulsory courses in the new Department.

Release of Examination Results

a. At the end of each semester, a provisional list of successful candidates in course examination shall be published by the Chief Examiner soon after the ratification of the

recommendation of the Board of Examiners by the Faculty Board.

b. The proceedings of Boards of Examiners are confidential and are in no circumstances to be disclosed at any time to any candidate or to any other unauthorized person.

c. However, without prejudice to Regulation (b) above, a student contesting a given grade after the release of results can appeal to the Vice-Chancellor, who shall cause the Head of Department to call for the affected paper of the candidate for re-marking. This shall be done after payment of the prescribed fee.

d. The final results of candidates for the award of a degree shall be published by the Registrar after they have been approved by Senate.

Withdrawal from the University

Students are considered withdrawn from the University when their case falls under any of the followings:

a. Termination of Studentship: A student that fails to register for courses in two consecutive semesters are credited with 2 Number of Registration Information (NRI) and subsequently withdrawn from the University.

b. Poor Academic Performance: Student is considered to have automatically withdrawn from the university if he/she scores a Cumulative Grade Point Average [CGPA] that is less than one in two consecutive semesters.

c. Voluntary Withdrawal: A student is also considered withdrawn when his/her application for voluntary withdrawal has been processed through all the statutorily meetings for such a case.

d. Gross Misconduct: A student can also be considered for withdrawal through expulsion from the University when found guilty of a gross misconduct by the University Administration. Offences leading to such misconduct includes: examination malpractice disobedience to the University Authority through one of several misdemeanours.

Final Assessment and Classification

Final assessment of the student can be summarized as follows:

a. A student's workload is defined in terms of course units. One unit represents one hour of lecture or one hour of tutorial, or 24 hours of practical work per week throughout a semester. All courses shall run for one semester or a full session of two semesters.

b. The final award and the class of the degree shall be based on the Cumulative Grade Point Average [CGPA] obtained by each candidate in all prescribed courses approved by the University. The final cumulative grade point average shall be calculated-on the basis of the total number of credit points and the total number of course units registered for during the course of the student's programme. In the case of a failed course, the candidate must repeat the course at the next available opportunity. If the course is an elective, the candidate may substitute another course which is an elective, and shall not be required to pass the failed elective course. If the course is a restricted elective, substitution can only be made from

the list of restricted electives. The failed grade would however be reflected in the transcript.

c. A candidate who scores a cumulative grade point average [CGPA] of less than 1.00 in two consecutive semesters shall be required to withdraw from the University

d. A candidate who has satisfactorily completed all requirements for the degree with an overall grade point average of not less than 1.50 shall be awarded the honours degree as indicated as follows:

I.	**First Class**	**4.50 - 5.00**
II.	**Second Class (Upper Division)**	**3.50 - 4.49**
III.	**Second Class (Lower Division)**	**2.40 - 3.49**
IV.	**Third Class Honours**	**1.50 - 2.39**
V.	**Pass**	**1.00 - 1.49**

Passes in required units of Special electives is a requirement for graduation.

Student Registration on E-Portal

Visit the university URL directly with https://my.elizadeuniversity.edu.ng/ (Figure 1). Follow the instruction. Pay the school fee (Figure 2) and register all the necessary courses from course list for the programme through the students' portal.

Academic Regulations (Rules and Regulations Governing the Conduct of Examinations)

1.6.1 Eligibility

All students who are registered for courses in a given semester are eligible to sit for examination in those courses EXCEPT for students in the following categories:

a. A student who fails to attend up to 75% of lectures or practical in any course.
b. A student who is absent from the University for one (1) semester without official notification and permission. Such a student is deemed by Senate to have withdrawn from the University.

The implementation of cases listed above is normally subject to Senate approval on the recommendation of the Faculty Board.

1.6.2 Examination Instructions to Students

Every student shall:

a.

i. be admitted into the Examination Hall only on the production of the University Identity Card, and/or Examination Card;
ii. ensure that he/she acquaints himself/herself with and adhere strictly to the instructions governing examinations in the University including those printed on the front cover of the answer booklets.
iii. have the full responsibility of ensuring, before the commencement of any examination or test that nothing incriminating is found in his/her possession or on materials he/she legitimately brought into the examination hall, e.g rulers, four figure tables, etc. to aid his/ her performance in the Examination

iv. conduct himself or herself in an orderly manner and obey all instructions of the invigilator/examiner.

v. not to be engaged in or attempt any manner of examination malpractice.

b. Students are not expected in the vicinity of the examination hall earlier than 30 minutes before the commencement of each examination. They are also required to keep strictly to the sitting arrangements. No candidate should, under any circumstances remove chairs arranged in halls used for examination purposes.

c. Students must report at the examination venues punctually at the time schedule for their papers. Students arriving later than half an hour for an examination may be refused entry into the examination hall.

d. Students must bring with them to the examination hall, their writing materials which may be permitted by these regulations (as stated here under). They are however not allowed to bring any books or papers except those that may be permitted or provided by the Department responsible for the examination being held. Students are warned in their own interest to ensure that lecture notes, textbooks, jotters, bags or any other unauthorized materials or aids etc. are not brought into the examination hall

e. The invigilator may search students before they are allowed into the examination hall

f. To ensure orderliness in the examination hall, seats will be arranged accordingly at each particular time.

g. Students are NOT ALLOWED to be in possession of any radio and audio equipment or mobile phone in the

examination hall. While any examination is in progress, no handset should therefore be found on any student.

h. Communication of any kind between candidates is strictly forbidden during examination. Any student found to be giving or receiving irregular assistance shall face disciplinary action

i. Silence must be observed in the examination hall. The only permissible way of attracting the attention of the invigilator is for the student to raise his/her hand.

j. The use of scrap paper is not permitted. Rough work must be inside the answer booklets, crossed neatly and boldly written "ROUGH WORK" before submission of the answer script.

k. Students offering mathematics or courses requiring technical instruments must bring their own mathematical or drawing instruments

l. Personal copies of Mathematical Tables will not be allowed in examination halls (see regulation on the use of calculators).

m. Students must use their matriculation numbers for the examination and not names.

n. Before handing in their answer scripts at the end of the examination, students must satisfy themselves that they have inserted, at the appropriate places, their Matriculation Numbers and the number of the question answered. Except for the question papers and any other materials, they may have legitimately brought with them (as indicated above), students are not allowed to remove or mutilate any paper or materials supplied by the University.

o. Students shall not normally be permitted to leave the examination hall during the first 30 minutes of any examination.

p. At the end of an examination, students must remain seated while invigilators go from row to row to collect answer scripts.

q. Students are required to sign against their matriculation numbers on the attendance register during the examination.

1.6.3 Invigilation of Examinations

a. Invigilators shall normally allow the students into the hall ten minutes before the commencement of the examination and to sit in an orderly manner. Blank answer sheets and other necessary required materials shall then be distributed.

b. Students shall not commence writing at the start of an examination session until authorised to do so by the invigilator. Students shall stop writing at the end of an examination session when similarly instructed.

c. About five minutes before commencement of the examination, the packet of question paper shall be opened and the papers distributed with face downwards, while students are warned not to start until they are told to do so.

d. At the scheduled time for the commencement of the examination and after the distribution of papers has ended, the invigilator shall ask the students to start and note the "exact time of commencement,' and the exact time to end the examinations, depending on the periods of time allowed for the examinations.

e. Invigilators shall pass round the students' attendance register corresponding to the examined course for the students to fill and sign during the examination.

f. Invigilators shall familiarize themselves with instructions to students and enforce the rules and regulations contained in these instructions.

g. During the examination, invigilators shall, exercise constant and vigilant supervision over the, students.

h. In any case of examination misconduct by students, the Chief Invigilator shall require the student(s) concerned to write and fill the irregularity form, and allow the student(s) to proceed with the examination. The Chief Invigilator shall report such cases to the Faculty Dean, the Head of Department and the Chief Examiner concerned within 24 hours. "

i. Invigilators shall ensure that students bring only authorized materials into the examination hall. Bags, books and other students' property must be left outside the examination hall. For this purpose, invigilators shall inspect the hall after students have been seated before the commencement of each examination.

j. No student may leave the examination hall during the first half hour of an examination except to go to the toilet or the first-aid room and must be accompanied by an attendant/invigilator of the same gender.

k. Normally, no student shall be admitted after the first half-hour of the examination and no question paper, shall be removed from the hall before the first half-hour of the examination has lapsed.

l. If any student shall have finished his/her paper before the time required, the Chief Invigilator at his/her discretion allow the student to submit his/her answer booklet and retire, otherwise, students may not normally leave the examination hall during the first and last half-hour.

m. Invigilators shall ensure that silence is maintained in the examination hall. The only permissible way of attracting the attention of the invigilator is by the student raising his/her hand.

n. Invigilators must inform students of the time, 30 minutes and five minutes before the close of the examination.

o. At the close of each examination, invigilators shall go round to collect from students, their answer booklets/scripts and check them against the attendance register.

p. Students are required to dress decently and not in a manner that is likely to create a disturbance in the examination hall or to distract the attention of other students.

q. No student shall take into examination hall or have in his/her possession during an examination any book or paper relevant to the examination unless specifically authorised. The invigilator/ examiner has authority to confiscate such document.

r. Students attending a practical examination must comply with the safety requirement of the laboratory in which their examination is held.

s. No students shall take into the examination hall any electronic calculator or other means of data storage or retrieval unless specifically authorised. When specified,

an electronic calculator must be approved for the University examinations.

t. The invigilator shall enclose the collected answer booklets/scripts and the corresponding attendance registers in the special envelopes provided by the Chief Examiner.

u. The Chief Invigilator shall sign and seal-the envelopes and 'submit them to the Chief Examiner concerned.-

1. 6.4 The use of Calculators and other Electronic Devices

a. For examinations in certain courses, the use of electronic calculator is permitted but the calculator must be non-programmable. Only one calculator shall be allowed per student. Organizers are not permitted.

b. The calculator must be small (hand-held), and battery-operated.

c. A student must not borrow another student's calculator during an examination.

d. The responsibility for correct operation of the calculator rests with the student alone.

e. Instruction manuals, calculator packets and containers are forbidden in the examination halls. Invigilators and Examination Assistants shall confiscate them whenever and wherever they are discovered in the examination halls.

f. The calculator must be switched off on entry into the examination room and can only be turned on when ready to be used.

g. Student shall declare their calculators and make them available for inspection by invigilators on entry into the examination hall.

h. Contravention of any of these regulations shall constitute examination malpractice or misconduct and shall so be treated.

1. 6.5 Absence from Examination

a. All students must present themselves at all University Examinations for which they have registered under these regulations. Students who fail to do so for reasons other than illness or accident or other exceptional causes shall be deemed to have failed that examination.

b. Misreading of the time table and such lapses on the part of the students shall not normally be accepted as satisfactory explanation for absence.

c. A student who falls ill during an examination period should report in writing to the Dean of his/her Faculty through his/her Head of Department with a report from the University's Director of Medical Services.

d. A student who is absent from an examination on account of illness confirmed by the medical evidence from the University Medical Centre may seek the permission of Senate to make up the examination at the next available opportunity without penalty. Approval for the make-up examination shall be given by Senate on the recommendation of Faculty Board.

1. 6.6 Examination Misconduct and Malpractices

Types of Examination Malpractices: Types of examination malpractice which are by no means exhaustive include:

a. Possession of question papers before examination /test or attempt to do so.

b. Swapping or attempt thereof of answers before, during or after examination/test.
c. Bringing into the examination hall, any unauthorized pieces of paper.
d. Tattooing: inscription of answers, hints or codes thereof on any part of the student's body/dress, or in any other manner whatsoever.
e. Passing information from one student to another in the examination hall.
f. Seeking or soliciting any assistance whatsoever from any other student or any other unauthorized person in the examination hall.
g. Any disorderly conduct before or during any examination or test.
h. Pre-arranged sitting pattern by any student or group of students in the examination hall with a view to facilitating unauthorized exchange of information.
i. Impersonation-one candidate arranging with another person to write an examination on his/her behalf.
j. Unauthorized possession of the University answers booklets or attempt thereof.
k. Assaulting/manhandling invigilators and/or attendant.
l. Any action or inaction of any student in and around the examination hall which is inimical to or subversive of the integrity of the University examination process, such as the offences listed above, shall constitute examination misconduct.
m. Offering information/assistance and accepting information/ assistance from another student during

examination is a breach of examination regulation and both carry equal punishment.

n. Students are not allowed to use unfair means in any University examination: unfair means shall include plagiarism- which means submitting a work that is part or fully from the work of another without due acknowledgement.

o. Any other irresponsible act not listed above but that from time to time be considered to jeopardize the essence of a good examination by the University Authority.

1.6.7 Procedure for Handling cases of Examination Misconduct

Examination misconduct shall continue to be processed by the Student Disciplinary Committee (SDC).

a. In any case of examination misconduct by student(s), the Chief Invigilator shall require the student(s) concerned to write and fill the irregularity form and allow the student(s) to proceed with the examination.

b. The Chief Invigilator shall write his own statement and report the case(s) of examination misconduct to the Chief Examiner who is also the Head of Department concerned for onward transmission to the Faculty Dean for necessary action(s).

c. On receiving the report, the Faculty Dean shall set up a Faculty Committee of 3 members to investigate the case; the report of this Committee shall be forwarded to the Vice-Chancellor.

1. 6.8 Procedure for Investigating Examination Misconduct Alleged

a. Failure to observe any of the examination rules of conduct or any breach thereof shall prima-facie constitute examination malpractice or misconduct generally.

b. At the discretion of the Chief Invigilator, a student may be asked to leave the examination hall when his/her conduct is judged to be disturbing or likely to disturb the examination. The Chief Invigilator shall submit a written report on any such action to the Head of Department and Dean of his/her Faculty at the end of the examination.

c. Any student suspected of any examination irregularities shall be required to submit to the Chief Invigilator, a written statement immediately after the paper. Failure to make a written statement shall be regarded as an admission of the allegations against him/her and may also be charged for insubordination. Reports from invigilators shall always-be through the Chief invigilators.

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Bachelor of Engineering in Electrical and Electronics Engineering (B.Eng. –Electrical and Electronics Engineering)

2.1 Introduction

The Department runs a 5-year programme leading to a Bachelor's degree (B. Eng.) in Electrical and Electronics Engineering. The B.Eng. programme in Electrical and Electronics Engineering is

built on a foundation of mathematics, computing science, and physical science. Each year of the program comprises a number of discipline-based courses and courses taught by other discipline areas. In the first two years, there are considerable number of courses common to all the Departments within the Faculty of Engineering. A small component of computer technology and computational software are introduced in the first year, with progressively larger components of Electrical and Electronics Engineering courses in the second, third and fourth year. The fifth year, which is the final year, is devoted exclusively to Electrical and Electronics Engineering courses. In the final year, students have the option to select specialty topics in areas such as electronics, control, communications, electrical machines and power systems.

2.2 Programme Philosophy

The underlying philosophy of the Electrical and Electronics Engineering programme centers on the need to key into the industrialization growth being ushered in by the recent advances and application of engineering and technology in the developing world. The thrust of the Electrical and Electronics Engineering programme is to ensure that our graduates are thoroughly trained in the key fields of Electrical and Electronics Engineering relevant to national development, especially in the industrial sector and the society at large. This is in line with the University's mission and vision "*to be a globally competitive institution that produces entrepreneurial, innovative and ethical graduates*" that possess "*appropriate skills and knowledge for the development of the nation and global competitiveness*"

2.3 Programme Objectives

The objectives of the programme are to:

i.) Provide quality and relevant engineering education to students

ii.) Pursue excellence through contributions to research, industry, and community.

iii.) Provide excellent training that enables the students acquire the higher-order critical and analytical thinking skills, research and problem solving abilities, and communication skills needed to operate effectively in an increasingly complex technical, business, and policy environment.

2.4 Programme Outcomes

The curriculum and syllabi have been structured in such a way that graduates of the Electrical and Electronics Engineering programme will possess the:

a) Ability to work and function in multidisciplinary teams,

b) Ability to analyze and provide solutions to engineering problems,

c) Ability to build and prototype complex electrical and electronic devices,

d) Ability to improve on present technologies by conducting experiments and research.

2.4.1 Degree Offered

Bachelor of Engineering in Electrical and Electronics Engineering (B.Eng. – Electrical and Electronics Engineering)

2.4.2 Admission Requirements

A. Unified Tertiary Matriculation Examination (UTME)

Admission to 100 Level is through the UTME of the Joint Admission Matriculation Board Examination in subjects including English Language, Mathematics, Physics and Chemistry. To be eligible for admission, candidates must have a minimum of five credit pass in the General Certificate of Education (Ordinary Level), or West African Senior Secondary Certificate Examination (WASSCE) or NECO or its equivalent at not more than two (2) sittings in the following subjects: Chemistry, Physics, Mathematics, English Language and any other relevant subject. UTME Subjects: English Language, Chemistry, Mathematics and Physics.

B. Direct Entry

- In addition to the requirements specified above in (a), candidates seeking admission to 200 Level must possess
  i. National Diploma (ND) at Upper Credit Level or equivalent in Electrical and Electronics Engineering or related discipline from recognized institutions, or
  ii. Credit passes at the General Certificate of Education (Advanced Level) or its equivalent in Chemistry, Physics and Mathematics.
  iii. Credit passes at IJMB, JUPEB, and CAMBRIDGE A-Levels in Chemistry, Physics and Mathematics.
  iv. Inter-University Transfer Mode: Students can transfer into 200-Level provided they have acceptable grades for the required 100 Level courses in their former Universities as evidenced in their academic transcripts.

- In addition to the requirements specified above in (a), candidates seeking admission to 300 Level must possess
  i. Higher National Diploma (HND) at Upper Credit Level or equivalent in Electrical and Electronics Engineering or related discipline from recognized institutions.
  ii. First degrees in related disciplines from recognized institutions.

C. Programme Duration

The normal duration of the academic programme is five academic sessions for students admitted to 100 - level through the UTME and four academic sessions for those admitted into 200 - level by Direct Entry. The minimum number of academic semesters required to be awarded a B.Eng. in Electrical and Electronics Engineering is three academic sessions. Students that fail to graduate at the end of normal academic sessions shall not be allowed to exceed a total of 15 semesters in the case of UTME students and 12 semesters in the case of Direct Entry students.

2.2.4 Graduation Requirements

Graduation Requirements

To be eligible for a degree of B.Eng. in Electrical and Electronics Engineering, of Elizade University Ilara-Mokin, a candidate must:

- pass all prescribed core courses as well as University and School required courses and the electives;
- complete a minimum of 187 units if admitted through UME; a minimum of 157 units if by 200-Level Direct Entry; a minimum of 121 units if by 300-Level Direct Entry, and obtain a CGPA of not less than 1.5; and,

- successfully complete all field projects, laboratory practical and industrial attachments. Direct Entry students are expected to register and pass the General Studies Courses required by the university.

LIST OF COURSES

100-LEVEL **1ST SEMESTER**

Course Code	Course Title	U	ST	L	T	P
MTH 101	General Mathematics I	3	C	2	1	0
PHY 101	General Physics I	3	C	2	1	0
PHY 103	Practical Physics I	1	C	0	0	3
CHM 101	General Chemistry I	3	C	2	1	0
CHM 103	Practical Chemistry I	1	C	0	0	3
GNE 101	Introduction to Computer Technology	3	R	2	0	3
GST 101	Communication in English I	2	C	1	1	0
GST 109	Use of Library Study Skills and ICT	1	C	1	0	0
GST 111	Citizenship and Human Kinetics Education	1	E	1	0	0
Total		**17/18**		**11**	**4**	**9**

100-LEVEL **2ND SEMESTER**

Course Code	Course Title	U	ST	L	T	P
GNE 102	Engineer –in– Society	1	C	1	0	0
GNE 104	Introduction to Computational Software	1	C	0	0	3
GNE 106	Introduction to Engineering Drawing	1	C	1	0	0
MTH 102	General Mathematics II	3	C	2	1	0
MTH 104	General Mathematics IV	3	C	2	1	0
CHM 102	General Chemistry II	3	C	2	1	0
CHM 104	Practical Chemistry II	1	C	0	0	3
PHY 102	General Physics II	3	C	2	1	0
PHY 104	Practical Physics II	1	C	0	0	3
PHY 106	Properties of Matter	1	C	1	0	0
GST 102	Communication in English II	2	C	1	1	0
GST 114	Philosophy, Logic and Issues in Science of Human Existence	1	E	1	0	0
Total		**20/21**		**13**	**5**	**9**

200-LEVEL **1ST SEMESTER**

Course Code	Course Title	U	ST	L	T	P	Prerequisite
GNE 251	Engineering Drawing I	3	C	1	0	6	-
GNE 253	Engineering Mathematics I	3	C	2	1	0	MTH 101
GNE 255	Applied Mechanics	3	C	2	1	0	-
GNE 257	Fundamentals of Electrical Engineering, I	2	C	2	0	0	-
GNE 259	Material Science	3	C	2	1	0	-
GNE 297	Fundamentals of Electrical Engineering Laboratory I	1	C	0	0	3	-
CSC 201	Computer Programming, I	3	C	2	0	3	-
GST 215	Entrepreneurship I	2	C	2	0	0	-
Total		**20**		**13**	**3**	**12**	

200-LEVEL **2ND SEMESTER**

Course Code	Course Title	U	ST	L	T	P	Prerequisite
GNE 252	Workshop Practice	2	C	1	0	3	-
GNE 254	Engineering Mathematics II	3	C	2	1	0	MTH 102
GNE 256	Fundamentals of Fluid Mechanics	2	C	2	0	0	PHY 106
GNE 258	Fundamentals of Electrical Engineering II	2	C	2	0	0	GNE 257
GNE 260	Strength of Materials I	3	C	2	0	3	-
GNE 262	Fundamentals of Thermodynamics	2	C	2	0	0	-
GNE 296	Fundamentals of Fluid Mechanics Laboratory	1	C	0	0	3	-
GNE 298	Fundamentals of Electrical Engineering Laboratory II	1	C	0	0	3	-
EEE 252	Introduction to Electrical and Electronics Engineering	2	C	1	0	3	-
GST 210	Introduction to Musicology	1	C	0	0	3	-

Course Code	Course Title	U	ST	L	T	P	Prerequisite
GST 216	Entrepreneurship II	2	C	2	0	0	-
Total		**21**		**14**	**`**	**18**	

200-LEVEL **LONG VACATION**

Course Code	Course Title	U	ST	L	T	P	Prerequisite
EEE 200	Student Work Experience Programme (SWEP)	3	C	0	0	9	-

300-LEVEL **1ST SEMESTER**

Course Code	Course Title	U	ST	L	T	P	Prerequisite
GNE 351	Engineering Mathematics III	3	C	2	1	0	GNE 253
EEE 351	Electromagnetic Fields	3	C	2	1	0	MTH 103
EEE 353	Instrumentation and Measurement	3	C	2	0	3	-
EEE 355	Physical Electronics	3	C	2	1	0	-

Course Code	Course Title	U	ST	L	T	P	Prerequisite
EEE 357	Electric Circuits	3	C	2	0	3	GNE 257
EEE 359	Analog Circuits & Devices	3	C	2	0	3	-
Total		**18**		**12**	**3**	**9**	

300-LEVEL **2ND SEMESTER**

Course Code	Course Title	U	ST	L	T	P	Prerequisite
GNE 352	Engineering Mathematics IV	3	C	2	1	0	GNE 254
GNE 354	Engineering Communications	2	C	2	0	0	-
EEE 352	Electrical Machines I	3	C	2	0	3	GNE 258
EEE 354	Electromagnetic Waves	2	C	2	0	0	EEE 351
EEE 356	Digital Circuits & Devices	3	C	2	0	3	-
EEE 358	Signals & Systems	3	C	2	1	0	EEE 357
EEE 360	Industrial Automation	3	C	2	0	3	-
Total		**19**		**14**	**2**	**9**	

300-LEVEL **LONG VACATION**

Course Code	Course Title	U	ST	L	T	P	Prerequisite
EEE 300	Student Industrial Work Experience I (SIWES I)	3	C	0	0	9	EEE 200

400-LEVEL **1ST SEMESTER**

Course Code	Course Title	U	ST	L	T	P	Prerequisite
GNE 451	Engineering Statistics	3	C	2	1	0	-
CPE 451	Data Communications & Networking	3	C	2	0	3	-
EEE 451	Microcontroller Technology & Applications	3	C	1	1	3	EEE 356
EEE 453	Control Systems I	2	C	2	0	0	EEE 357
EEE 455	Electrical Power Principles	3	C	2	1	0	EEE 357
EEE 457	Communication Principles	3	C	2	1	0	-
EEE 459	Introduction to Machine Learning	3	C	2	1	0	-

Course Code	Course Title	U	ST	L	T	P	Prerequisite
EEE 461	Electrical & Electronics Laboratory	1	C	0	0	3	-
Total		**21**		**13**	**5**	**9**	

400-LEVEL 2ND SEMESTER & LONG VACATION

Course Code	Course Title	U	ST	L	T	P	Prerequisite
EEE 200	Student Work Experience Programme (SWEP)	3	C	0	0	9	-
EEE 300	Student Industrial Work Experience I (SIWES I)	3	C	0	0	9	EEE 200
EEE 400	Student Industrial Work Experience II (SIWES II)	9	C	0	0	27	EEE 300
Total		**15**					

500-LEVEL 1ST SEMESTER

Course Code	Course Title	U	ST	L	T	P	Prerequisite

GNE 551	Engineering Law & Management	3	C	3	0	0	-
EEE 551	Digital Signal Processing	3	C	2	1	0	-
EEE 553	Power Electronics & Drives	3	C	2	1	0	EEE 355
EEE 555	Final Year Project I	3	C	0	0	9	-
EEE 557	Electrical Machines II	3	C	2	1	0	EEE 352
	Electives (2 courses)	4	E	4	0	0	
Total		**19**		**14**	**4**	**9**	

ELECTIVES

Course Code	**Course Title**	**U**	**ST**	**L**	**T**	**P**	**Prerequisite**
GROUP A:	**COMMUNICATIONS**						
EEE 559	Telecommunication Engineering	2	E	2	0	0	EEE 457
EEE 561	Digital Communication Systems	2	E	2	0	0	EEE 457
EEE 563	Antenna Theory and Applications	2	E	2	0	0	EEE 351

EEE 565	Electronic Communications	2	E	2	0	0	-
GROUP B:	**POWER SYSTEMS**						
EEE 567	Power System Analysis I	2	E	2	0	0	EEE 455
EEE 569	Power Systems Protection & Control	2	E	2	0	0	EEE 352
GROUP C:	**MECHATRONICS & CONTROL**						
EEE 571	Introduction to Mechatronics Design	2	E	2	0	0	-
EEE 573	Advanced Electronic Circuits	2	E	2	0	0	EEE 359
EEE 575	Control Systems II	2	E	2	0	0	EEE 453
EEE 577	Sensors, Actuators and Instrumentation	2	E	2	0	0	EEE 353

500-LEVEL 2ND SEMESTER

Course Code	Course Title	U	ST	L	T	P	Prerequisite
GNE 502	Engineering Economics & Valuation	3	C	3	0	0	-
EEE 552	Reliability & Maintainability of Electrical Systems	2	C	2	0	0	-
EEE 554	Electrical Services Design	3	C	2	1	0	-
EEE 556	Final Year Project II	3	C	0	0	9	-
	Electives (3 Courses)	6	E	6	0	0	
Total		**17**		**14**	**2**	**9**	

ELECTIVES

Course Code	Course Title	U	ST	L	T	P	Prerequisite
GROUP A:	**COMMUNICATIONS**						
EEE 558	Microwave and Radar Systems	2	E	2	0	0	EEE 457

EEE 560	Telecommunication Services Design	2	E	2	0	0	-
EEE 562	Digital Computer Networks	2	E	2	0	0	-
CPE 558	Digital Image Processing	2	E	2	0	0	-
GROUP B:	**POWER SYSTEMS**						
EEE 564	Switchgear & High Voltage Engineering	2	E	2	0	0	EEE 455
EEE 566	Renewable Energy	2	E	2	0	0	-
EEE 568	Power System Analysis II	2	E	2	0	0	EEE 567
EEE 570	Power Quality Control	2	E	2	0	0	-
GROUP C:	**MECHATRONICS & CONTROL**						
EEE 572	Robotics	2	E	2	0	0	-
EEE 574	Modern Control Engineering	2	E	2	0	0	EEE 453
EEE 576	Embedded Systems Design	2	E	2	0	0	EEE 451

10.0 COURSE SYNOPSIS

GNE 101 Introduction to Computer Technology
(3 Units)

History of Computers; functional components of a computer; characteristics of a computer system. Definition of computer science. History of computer science and their generations, Computer Hardware; Modern I/O units. Software: Operating Systems, Application Packages Program: Development; Flowcharts and Algorithms; Program Object; VISUAL BASIC programming language serves as the vehicle to illustrate the many concepts

GNE 102 Engineer –in– Society
(1 Unit)

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

GNE 104 Introduction to Computational Software
(1 Unit)

This course covers the introduction and applications of commonly used computational software packages. Overview of Computational Software. Evolution and trends in Computational Software development. Using MATLAB as an example of computational Software. Introduction to MATLAB. Basic

features of MATLAB. Creating MATLAB variables; managing MATLAB workspace; MATLAB mathematical functions. Basic plotting; Matrix generation; Array operations and Linear equations. Introduction to programming in MATLAB. Control flow and operators. Debugging M-files. Introduction to other computational software packages: Excel, GNU Octave and Scilab.

GNE 106 Introduction to Engineering Drawing
(1 Unit)

Introduction to drawing instruments, scales, draughting aids and their proper use. Size of paper and drawing layout. Dimensioning, line work, layout and lettering. Geometrical constructions and Engineering graphics. Graphical calculus and Applications. Circles and Tangents. Conic sections, various methods of their construction. Cycloids, epicycloids and hypocycloids. Involute. Archimedes spiral. Loci: the helix (cylindrical and conical) single and multi-start threads. Introduction to projections.

CHM 101 – GENERAL CHEMISTRY I
(3 UNITS)

Atoms, atomic structures, atomic theory, atomic spectra, Aufbau method, Hund's rule, Pauli Exclusion principles, Periodicity and periodic table, molecules, chemical equation and stoichiometry Rates of chemical reaction, energetics Thermochemistry and simple calculations involving Hess's law, Bonding and intermolecular forces, Hybridisation and shapes of molecules (Valence Forces; structure of Solids; molecular and ionic forces). metals and extraction of metals, The Chemistry of

selected metals and non- metals Chemical equilibrium reactions, Properties of gases, solutions, Redox reactions, Introduction to Electro chemistry, electrolytic and galvanic cells, Fuel cells, electrode potential, half-cell equation. Faraday laws of electrolysis, Corrosion. Colligative properties, corrosion, Acid, Bases and salts, Introduction to Radioactivity

CHM 102 – GENERAL CHEMISTRY II
(3 UNITS)

Historical survey of the development and importance of organic chemistry, nomenclature and classes of organic compounds, Homologous series; isolation and purification of organic compounds; qualitative and quantitative- determination of empirical and molecular formulae, percentage purity, yield, organic chemistry; stereochemistry; determination of structure of organic compounds; Electronic theory in organic chemistry; Saturated hydrocarbons and Unsaturated hydrocarbons; alkenes, alkynes and aromatics. Functional group; carbonyls, halides, carboxylic acids and hydroxyl, Valence Forces; structure of Solids; molecular and ionic forces. The Chemistry of selected metals and non- metals–relative abundance

CHM 103 – PRACTICAL CHEMISTRY I
(1 UNIT)

Co-requisite CHM 101

Calibration of Measuring Instrument; Standardization of HCl with Standard Sodium carbonate; Standardization of alkali with standard potassium hydrogen phthalate. Determination concentrations of commercial (H_2SO_4; HNO_3; NaOH); Preparation of Sulphide of Copper and determination of its

Empirical Formula; Determination of the atomic weight of a metal by forming its Oxides; Determination of atomic weight of a metal from the volume of Hydrogen it displaced from an acid; preparation of double salts; determination of heat of neutralization; determination of Faraday's constant. Introduction of scientific techniques to local science in the environment.

CHM 104 – PRACTICAL CHEMISTRY II
(1 UNIT)

Co-requisite CHM 102

Identification of elements in an organic compound Lassaigne: sodium fusion Test; Ignition Tests; Separation of mixtures; determination of Melting points; Re-crystallisation; Simple experiment reactions of Urea (carbamide); Test for aldehydes; Detection of carbonyl group .Ignition test, Estimation of iron in ferrous ammonium sulphate using standardized potassium permanganate, Qualitative inorganic analysis

PHY 101 – GENERAL PHYSICS I
(3 UNITS)

Space and Time, frames of reference, Invariance of physical laws, relativity of simultaneity, relativity of time intervals, relativity of length, units and dimension; standards and units, unit consistency and conversions. Kinematics vectors and vector addition, components of vectors, unit vectors, Products of vectors. Displacement Time and average velocity, instantaneous velocity, average acceleration, motion with constant acceleration, freely falling bodies, position and

velocity vectors, acceleration vector, projectile motion. Motion in a circle and relative velocity. Fundamental laws of mechanics: forces and interactions, Newton's first law, Newton's second law, mass and weight, Newton's third law. Statics and dynamics: application of Newton's laws, dynamics of particles, frictional forces, dynamics of circular motion. Galilean invariance, universal gravitation, gravitational potential energy, elastic potential energy, conservative and non-conservative forces. Work and energy, kinetic energy and the work-energy theorem, power, momentum and impulse, conservation of momentum, collisions and momentum conservation, elastic collisions, centre of mass. Rotational dynamics and angular momentum angular velocity and acceleration, energy in rotational motion, parallel axis theorem, torque, torque and rotation about a moving axis, simple harmonic motion and its applications. The simple pendulum, damped oscillations, forced oscillations and resonance.

PHY 102 – GENERAL PHYSICS II
(3 UNITS)

Pre-requisite PHY 101

Electrostatics: Conservation law of electric charges, electrons and electrostatics, Coulomb's law, electric field and forces, electric field line, electric dipoles charged particles in an electric field, charge and electric flux, Gauss's law and its applications, electric potential, electric potential due to a single charge, electric potential due to a dipole, electric potential due to continuous charge distribution equipotential surfaces. Conductors and currents: electric current, resistors and resistance, electric power, capacitors in series and parallel,

energy storage in capacitors and electric field energy, Gauss's law in dielectrics. Magnetism: magnetic field, magnetic field lines and magnetic flux, motion of a charged particles in a magnetic field, magnetic force on a current carrying conductor, Ampere's law, Biot-Savart law, electromagnetic induction, inductance, self-inductance, mutual inductance, Maxwell's equation, electromagnetic waves and oscillations.

PHY 103 – PRACTICAL PHYSICS I
(1 UNIT)

Co-requisite PHY 101

This introductory course emphasizes quantitative measurements, the treatment of measurement errors and graphical analysis. A variety of experimental techniques will be employed. The experiments include: Mechanics: timing experiments, simple pendulum, compound pendulum, measurement of g, moments, determination of moment of inertia, measurement of viscosity, use of force board, law of momentum. Optics: reflection using plane mirror, convex/concave mirror, concave/convex lens, refraction using a prism, critical angle, apparent depth/real depth, simple microscope, compound microscope.

PHY 104 – PRACTICAL PHYSICS II
(1 UNIT)

Co-requisite PHY 102

Electricity: Ohm's law, heating effect of a current internal resistance of a cell, Metre/Wheatstone bridge, potentiometer measurement of ece, plotting of magnetic field. Heat:

measurement of specific capacity of water, and a solid, expansion of gas experiment using a long capillary tube, Joule's law. Sound: resonance tube, Sonometer.

GNE 251 Engineering Drawing I
(3 Units)

Development of geometrical figures and intersection of solids and curves. Projections – lines, planes and simple solids. Orthographic projections in first and third angles. Isometric Projection; sections and sectioning, auxiliary views and staggered sectioning. Pictorial/Freehand Sketching. Conventional practices with Simple examples, including threads and threaded fasteners, cam profiles and Assembly drawing from detailed components. Introduction to Computer Aided Drafting: Electronic draughting packages: principle and use in engineering design. Simulation packages: principle and use in engineering.

GNE 252 Workshop Practice
(2 Unit)

Safety procedure in workshop and Workshop setting; Types of workshop equipment, machines and materials; Use of instruments and tools (hand and machine tools), Measurement and marking out; Bench work and fitting; Machine operation practice. Carpentry: Hand tools and working principles; Joints and fastenings: bolt, rivet, welding, brazing, soldering. Invited lectures from Professionals.

GNE 253 Engineering Mathematics I
(3 Units)

Complex analysis – Elements of complex algebra, trigonometric, exponential and logarithmic functions. Real number, sequences and series. Composite functions, matrices and determinants. Vectors – Elements, differentiation and integration, Elements of linear algebra, Calculus – Elementary differentiation. Relevant theorems.

GNE 254 Engineering Mathematics II
(3 Units)

Differential equations – Exact Equations. Methods for second order equations. Partial differential equation. Simple cases – Applications, Numerical Analysis – linear equations, non-linear equations. Transformation and mapping: special functions. Finite difference operators: Introduction to linear programming.

GNE 255 Applied Mechanics
(3 Units)

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

GNE 256 Fundamentals of Fluid Mechanics
(2 Units)

Nature and types of fluids; Physical properties of fluids; Fluid statics, stability of submerged and floating bodies; Fluid flow

concept; conservation of mass, momentum energy; Simple applications of conservation laws; Flow measurement.

GNE 257 Fundamentals of Electrical Engineering I (2 Units)

Fundamental concepts – Lumped circuit elements, ideal sources, passive and active components. Basic circuit laws and theorems – Ohms Law, Kirchhoff's Laws, Nodal and Mesh analysis, Thevenin and Norton's theorems, superposition, delta-star transformation, maximum power transfer theorem, reciprocity theorem. Single time-constant circuits, resonance circuits, Q-factor, transient response, steady state response of circuit elements and networks. Alternating current (AC) circuits: root mean square (RMS) values and peak values of an AC waveform, complex impedance, admittance, susceptance, and phasor diagrams. Introduction to electronics, non-linear elements in a simple electrical and electronic circuits, semiconductors, rectification circuits, smoothing circuits.

GNE 258 Fundamentals of Electrical Engineering II (2 Units)

Review of basic circuit laws and theorems. Periodic waveforms – average and effective values. Electrical measuring instruments - types of instrument, applications and connections of ammeters, voltmeters, single-phase wattmeter single-phase watt-hour-meters, oscilloscopes. Transducers: pressure transducers, displacement transducers, temperature transducers, speed sensors and Bridge measurements: AC and DC bridges. Electric fields and capacitors, magnetic fields and inductors. Energy stored in capacitors and inductors. Electromagnetic induction, magnetic forces, magnetic coupling, self and mutual inductance,

magnetic field strength, B-H curves, magnetic circuits. Introduction to electric machines, machine designs, DC generators and motors. Basic machines: DC machines, principles of commutation. Torque and EMF expressions, Characteristics of series, shunt, and compound wound motors. Introduction to motor starter circuits and motor control circuits for single-phase machines. Speed control and electric braking, Introduction to AC machines, single-phase alternating current (AC) circuits, power factor correction, transformers and applications.

GNE 259 Materials Science
(3 Units)

Review of properties of matter, relationships between structure and properties of metals, alloys, ceramics and plastics. Atomic and molecular structure, crystals, Metallic states, Defects in crystals, conductors, semi-conductors and insulators. Alloy theory – Application to industrial alloys – steel in particular. Engineering Properties – Their control, Hot and cold working, heat treatment, etc. Creep, fatigue and fracture. Corrosion and corrosion control. Non-metallic materials – glass, rubber, concrete, plastics, wood and ceramics. Elastic and plastic deformations: Defects in metals.

GNE 260 Strength of Materials I
(3 Units)

Hooke's law; Method of superposition; Stress and deformation resulting from temperature changes; Elastic Constants; Stress in thin cylinders and spheres; Stresses on inclined planes. Principal stresses, Mohr's circle. Structural mechanics of statistically

determinate rigid body systems and plane pin-jointed frames; Bending moment and shear force in beams, Simple beam and deflection of beam, truss and elastic buckling of columns; Simple torsion and application; Stress and strain transformation equations.

GNE 262 Fundamentals of Thermodynamics (2 Units)

Basic concepts, quantitative relations of zeroth, first (applications to open and closed systems, steady state flow/ Bernoulli's equation and applications), second and third laws of thermodynamics. Behaviour of pure substances and perfect gases; Ideal gas cycles.

GNE 296 Fundamentals of Fluid Mechanics Laboratory (1 Unit)

Determination of fluid properties. Pressure measurement. Hydrostatic force on plane surface. Determination of metacentric height. Determination of stability of floating bodies. Verification of Bernoulli's theorem.

GNE 297 Fundamentals of Electrical Engineering Laboratory I (1 Unit)

Identification of resistors and resistor colour coding, series connections, and parallel connections. Verification of Ohm's law, Kirchhoff's laws, and loop analysis. Verification of Thevenin's, Norton's theorem, superposition theorem, and maximum power transfer theorem. Series and parallel resonant circuits, RLC series and parallel Circuits. Full wave rectification circuit, monostable, astable, and bistable multivibrators.

GNE 298 Fundamentals of Electrical Engineering Laboratory II (1 Unit)

Oscilloscope and AC waveforms; Electrical measuring instruments. Pressure transducers, displacement transducers, temperature transducers, speed sensors. Bridge measurements: AC and DC bridges. Experiments on windings of series, shunt, and compound wound single-phase motors. Experiments on characteristics (torque, speed, I V, etc.) of single-phase DC machines – generators and motors.

GNE 351 Engineering Mathematics III (3 Units)

Analytic geometry – co-ordinate transformation, solid geometry, polar, cylindrical and spherical coordinates. Vector Theory – Dot product, cross product, divergence, curl and del operators, gradient, line, surface and volume integrals and related theorems. Elements of functions of several variables - double integrals, triple integrals, line integrals and surface integrals, differentiation and integrals of vectors. Singular valued functions, multivalued functions. Polynomials and their zeros – real zeros and complex zeros. Linear Algebra, Eigen-values and Eigen-vectors. Direct (matrix) methods for the solution of linear equations; Iterative (matrix) methods for the solution of simultaneous linear equations; convergence. Use of appropriate software packages (e.g. MATLAB) should be encouraged

GNE 352 Engineering Mathematics IV (3 Units)

Fourier series – Euler coefficients, orthogonal functions, even and odd functions, Sine and Cosine, functions, simple

applications, Fourier integral, Gamma, Beta and probability functions. Fourier and Laplace transforms. Numerical differentiation, finite difference equations. Runge-Kutta and other numerical methods in the solutions of ODE. Interpolation, Curve fitting, numerical integration, derivation and simple numerical computation of quadrature rules. Differential equation of second order – series solutions. Legendre and Bessel functions and their properties. Eigen value problems. Use of appropriate software packages (e.g. MATLAB) should be encouraged.

GNE 354 Engineering Communications
(2 Units)

Oral communication: Public speaking skills with effective use of visual aids and statistical and technical information. Principles of effective communication in interpersonal and mass communication process. Effective reading skills-extracting main ideas and reading for specific information through speed reading. Written communication: principles of technical writing. Planning and experimental design; data collection and analysis; scientific writing and presentation. Grant writing and funding sources. Ethics and intellectual property. Professional use of English Language for letters, specification descriptions, presentation of charts, graphs, tables, writing of proposals in reports. Case studies of major engineering designs and construction/fabrication as well industrial failures; seminar presentation of reports and proposals. Project report presentation.

GNE 451 Engineering Statistics
(3 Units)

Elements of statistics; Descriptive statistics, frequency distribution, populations and sample, central tendency, variance data sampling, mean, median, mode, mean deviation, percentiles etc. Probability. Binomial, poison hypergeometric, normal distributions, etc. Statistical inference intervals, tests hypothesis and significance. Estimating Engineering Quantities: Estimators Methods, Confidence Limits and Tolerance. Hypothesis testing; Statistical Inference and Engineering decision situations, operating characteristics curves, parametric and non-parametric tests of engineering data. Introduction to analysis of variance, regression. ANOVA, R-estimates, confidence intervals, correlation analysis, regression analysis. Statistical computer routines. Introduction to random process and stochastics.

GNE 551 Engineering Law & Management
(3 Units)

Law of contracts for Engineers: offer, acceptance, communication termination. General principles of criminal law. Law of torts: definition, classification and liabilities. Patents: requirements, application, and infringement. Registered designs: application, requirements, types and infringement. Company law. Labour law and Industrial Law. Principles of organization; elements of organization; management by objectives. Financial management, accounting methods, financial statements, cost planning and control, budget and budgetary control. Depreciation accounting and valuation of assets. Personnel management, selection, recruitment and training, job evaluation and merit rating. Industrial psychology. Resource management;

contracts, interest formulae, rate of return. Methods of economic evaluation. Planning decision making; forecasting, scheduling. Production control. Gantt chart, CPM and PERT. Optimization, linear programming as an aid to decision making, transport and materials handling. Raw materials and equipment. Facility layout and location. Basic principles of work study. Principles of motion economy. Ergonomics in the design of equipment and process.

GNE 502 Engineering Economics & Valuation
(3 Units)

Economics of business settings, costing of production systems. Objectives of cost analysis and control. Sources of finance, money and credit for projects. Investment Appraisals. Resource Allocation. Interest rates. Interest formulas and problems. Annual costs. Present worth, rates of return. Cost reducing. Depreciation accounting. Valuation of assets. Financial management; accounting methods, financial statement, elements of costing. Budget and budgeting control. Dwelling with multiple alternatives, uncertainties, planning, and Decision-making procedures. Macroeconomics, Economic growth, National Income. Economic of technological change. Economic analysis of engineering projects; value systems economic decisions on capital investments and choice of engineering alternatives; new projects, replacement and abandonment policies, risky decisions; corporate financial practices. Analysis of tender and project feasibility valuation.

EEE 200 Student Work Experience Programme (SWEP) (3 Units)

A 2-months student work experience within the university.

EEE 252 Introduction to Electrical and Electronics Engineering (2 Units)

The course provides an introduction to key concepts in Electrical and Electronics Engineering through a series of group mini-projects. These key concepts spans across different fields of Electrical and Electronics Engineering such as control and automation, robotics and mechatronics, communication and signal processing, embedded systems, and emerging technologies. Issues addressed in the context of circuits, computer programming, control systems, motion and mechanisms, probabilistic inference problems, signal acquisition and processing, and transducers. Use of laboratory instruments, devices and software tools that will stimulate students' interest in this exciting and interesting discipline.

EEE 300 Student Industrial Work Experience I (SIWES I) (3 Units)

A 3-months student work experience outside the university.

EEE 351 Electromagnetic Fields (3 Units)

Review of electric fields and magnetic fields. Static field vs time-varying fields. Separation vectors. Electromagnetic laws in differential and integral forms – separation vectors, Coulomb's law, electrostatic fields due to point charges, multiple-point charges and various charge distributions. Gauss law, boundary

condition, electric potential, Laplace, and Poisson equations. Magnetostatic fields, magnetostatic induction, Biot-Savart's law, magnetic flux, field strength, vector potential, magnetic field in and around current carrying conductors, conduction and displacement current. Ampere's law. Faraday's law. Lorentz law. Application examples - application of electromagnetic effects to DC & AC machines, communication and micromechanical systems. Introduction to Maxwell's equations. Design project.

EEE 352 Electrical Machines I
(3 Units)

Electromechanical energy conversion concepts, rotating magnetic fields, magnetic circuits, magnetic coupling, mutual inductance. The focus of this course is on single phase machines. Principle of machine winding, concentrated and distributed windings, lap and wave windings. DC machines: generators, motors, shunt and series and compound wound DC machines – design, construction, flash-over, sparking, performance characteristics. Transformers: Phasor diagrams, equivalent circuits, regulation, efficiency, characteristics, design, construction, open-circuit, short-circuit test, and polarity tests. Auto-transformers, instrument transformers, single-phase, three-phase transformers, and connections. Parallel operation of transformers. Faults on machines, methods of starting and protection of machines. Induction Machines: Magnetic flux, distribution of induced EMF, equivalent circuit, power balance, and equivalent circuit referred to stator. Torque-slip characteristics for generating and motoring actions; circle diagrams. Methods of starting and speed control. Double cage

induction motor. Single phase motors. Introduction to Synchronous Machines. Motor starter circuits and motor control circuits for single-phase machines. Basic principles of selection of motors, generators and transformers for practical applications.

EEE 353 Instrumentation and Measurement
(3 Units)

General Instrumentation, Basic Meter connections in DC measurement. Basic meter connections in AC measurements; ammeter, voltmeter, electro-dynamometer and wattmeter, instrument transformers; DC and AC bridges and their applications; general form of AC bridge universal impedance bridge; Electronic instruments for the measurement of voltage, current resistance and other circuit parameter, electronic voltmeters, AC voltmeters using rectifiers, electronic multimeter, digital voltmeters; oscilloscope, probes, sampling effects, impedance effects. Instruments for generating and analyzing waveforms; square-wave and pulse generator, signal generators, function generators, wave analyzers, Electronic counters and their applications: time base circuitry, universal counter measurement modes; Analog and digital data acquisition systems: tape recorders, D/A and A/D conversions, sample and hold circuits. Indicating instrument; moving coil, moving iron, thermal, electrostatic, induction type instrument, I, V, kWh, PF instruments, dynamometer, frequency measurement, digital bridges, and analog electronic measuring instruments, transducers, gauges, recorders. Data conversion and interfacing. Digital electronic measuring system. Data logging and displays. Data Acquisition Systems, software Data

Conversion. Multiplexing, Encoders. Transducers: analog electronic instruments for voltage, power wave-form, frequency and phase measurements. Digital instrumentation. Theory of errors: absolute and relative errors. Laboratory Practicals.

EEE 354 Electromagnetic Waves
(2 Units)

Time-varying magnetic and electric fields; Maxwell's equation (in rectangular co-ordinates and vector-calculus notation): Derivation of Maxwell's equations; Applications of Maxwell's equations. Dielectric, conductors and ionized media. Propagation of electromagnetic waves in free space and in material media. Solution of wave equations. Speed and energy of electromagnetic waves; Poynting vector; boundary conditions, uniqueness theorem, image method. Wave propagation in dielectric media; wave propagation in good conductors, skin effect. Simple class demonstrations. Introduction to transmission lines, wave-guides and optic fibers. Transmission line theory including wave-guides, striplines, and resonators. Smith's Chart. Radiating elements. Introduction to RF design, antenna design and theory. Application examples that employ electromagnetic phenomena for signals and power transmission in RF, microwaves, optical and wireless communication systems. Design project.

EEE 355 Physical Electronics
(3 Units)

Nature of atom. Basic concepts of semi-conductors charge carriers, effective mass, mobility, conductivity life time. Free electron motion in static electric and magnetic fields, electronic

structure of matter, conductivity in crystalline solids. Theory of energy bands in conductors, insulators and semi-conductors; energy band diagram; atomic bonding in semiconductors; electrons in metals and electron emissions; carriers and transport phenomena in semi-conductors; characteristics of some electronic devices – junction diodes, transistors, vacuum tubes, photoresistors, photocell and light emitting diode. Continuity equation, flow equations, Hall Effect; bipolar transistors - characteristics, CB, CC, CE configurations; switching devices. Fabrication techniques of elementary discrete devices and integrated circuit (IC) technology – BJT, MOSFETs, IGBT etc.

EEE 356 Digital Circuits & Devices
(3 Units)

Digital vs. analog systems. Number Systems and Codes. Simplification of Logic expressions using Boolean algebra. Karnaugh maps. Basic digital electronics. Switching circuit design. Design of Logic Gates. Wave shaping sequential circuits, definition, and characteristics and design. Logic devices and families: TTL, ECL, RTL, DTL, CMOS, LSI, VLSI digital systems design. Flip-flops, memory circuits. Application of Flip-flops in the design of counters, registers and timers. Combinational logic realization with gates, multiplexers, read only memories (ROMs) and programmable logic arrays (PLAs). State machine analysis and design: state diagram, state flip-flops, Input and Output forming Logic, State assignments, redundant states, sequential counters, and mainly synchronous systems, state machine realization with multiplexers, ROMs and PLAs. Asynchronous systems approach to digital systems design, Top-Down design, trial-and-error methods. Introduction

to computer structures: register, transfers, hardware programming methods, von Neumann machines, and memory systems standard logic functions with MSI circuits: seven segment display drivers, parity generator/checker, encoders, comparators, adders, etc. Analysis and synthesis of combinational logic circuit. Simplification of switching functions. Computer-aided minimization of switching functions. Algebraic methods for determining prime implicants. Mixed signal design, analog and digital grounding. Digital system design hierarchy. Memory devices. Latches, Flip-flops. Modular Design. Decoders. Implementing Logic functions using decoders. Encoder circuit structures. Multiplexer circuits. Laboratory-based Project.

EEE 357 Electric Circuits
(3 Units)

One-Port and Two-Port networks – introduction to devices and components, lumped circuit abstraction. Linear Circuits – energy storage elements, transient response of first and second-order systems, frequency domain analysis, operational amplifiers and applications. AC circuit analysis techniques, power factor, sinusoidal steady-state response, phasor analysis of AC circuits. Laplace transforms and applications to circuit analysis. Electromechanical circuits – resonance, energy transfer, Q-factor, oscillators and resonators. Active and Passive Filters – design, frequency response of low-pass, band-pass, and high-pass filters. Sallen-Key filter design. Nonlinear circuit applications – analysis of circuits with non-linear resistors, diodes, MOSFETs. Laboratory-based Project.

EEE 358 Signal and Systems
(3 Units)

This course emphasizes the concept of signals, continuous-time systems, discrete-time systems, and analysis of such systems from circuits perspective. Signal classification, signal properties, types of signals. Energy and power signals. Step, ramp and impulse signals. Time-domain analysis of signals: convolution, correlation, and impulse response. Signal sampling and sampling theorem, Types, classification, and properties of systems; mathematical models of physical systems; analogous concepts in electrical, electronic, mechanical and thermal systems. Transfer function models, frequency-response, resonance, state-space models, Basis functions. Fourier transforms, properties and applications. Laplace Transforms, properties and applications. Sampling. Discretization. Difference equations. Z transforms and applications. Filters (analog and digital) - active and passive - Butterworth, Chebyshev filters, simple digital filters, linear op-amp circuits, non-linear op-amp circuits, signal noise. Modularity, two-port network analysis & synthesis, ladder networks, T-networks, pi (π) networks. Physical realizability, stability, poles and zeros, Relationship between time and frequency domain models of dynamic systems. Applications in mechatronics and communication systems. Detailed use of MATLAB-SIMULINK, Python and other CAD packages

EEE 359 Analog Circuits & Devices
(3 Units)

The BJT transistor, its characteristics (AC-DC load lines), small signal amplifier, single-stage transistor amplifiers using BJTS

and FETs, equivalent circuit and calculation of current gain, voltage gain, power gain, input and output impedance, CB, CC, CE configurations, multi-stage amplifier using BJTs and FETs, small-signal analysis and large-signal analysis. Semiconductor devices – models, characteristics and applications, small signal amplifiers. Audio amplifiers, class A, AB, B, C, and push-pull design. Operational Amplifiers: Parameters and applications, feedback, oscillators, power amplifiers, high-frequency amplifier, tuned amplifier, broadband and narrow-band amplifiers, power amplifiers, differential amplifiers, voltage and current stabilizing circuit, voltage amplifiers. Laboratory-based project to include applications in communication systems.

EEE 360 Industrial Automation
(3 Units)

Overview of industrial automation, basic concepts, terms and components. Programmable Logic Controllers (PLCs), ladder logic, process automation, sensors, actuation, flow valves, hydraulics, pneumatic logic, PLC control. Sequence control, ladder logic diagrams, relay logic control & interlocking control circuits, relay ladder logic (RLL), sequential function chart, state chart, process timing diagram, PLC addressing an instructions, timers and counters, I/O modules and wiring. Introduction to function and operation of pneumatic and electrical equipment used in electro pneumatics control including pneumatic supply, input elements, processing elements, control elements and working elements, electrical sensing (limit switches, potentiometer, proximity, colour, photoelectric & temperature sensors) and switching devices. Motor control panel design. PLC interfacing with HMI, motors and electric drives. Protocols

for industrial automation, functional safety, system integration, PLC-based industrial installation, CNC machines and programming, plant floor communication, industrial networks, fieldbus networks, DCS, SCADA, automation systems installation, maintenance, and troubleshooting. Computer process control. Computer integrated manufacturing systems.

EEE 400 Student Industrial Work Experience II (SIWES II) (9 Units)

A 6-months student work experience outside the university.

EEE 451 Microcontroller Technology & Applications (3 Units)

Microprocessor Architecture: Von Neumann and Harvard microprocessor architectures; hardwired vs. stored program concept; principle of operation, advantages, disadvantages. Microcontroller vs Microprocessor. Types of Microcontrollers, Applications of Microcontrollers, Interrupts, I/O Ports; Peripherals Devices: Intel Programmable peripheral interface, Pin Description, Architecture, Operation Modes. Arithmetic and logical operations; ripple-carry adders; carry-select and carry-lookahead techniques; bit-wise AND-OR-NOT operations; and bit-shifting and bit-rotation operations. Memory: notations for describing memories; address decoding inside memory devices. PIC architectures. Operation, programming and application for PIC18xxx: Standard Peripheral interfaces: Serial communications interfaces; I2C; USB. Digital interfacing: general purpose and Structure of digital input/output resources on the PIC18Fxxx microcontroller family; Analogue interfacing: Comparator module; Analogue-to-Digital

Converter (ADC) module. Peripheral devices for PIC18xxx family of devices: Digital input/output facilities; ADC converters; Counter/timers; Polled and interrupt-driven transfer. Accessing memory-mapped peripheral interfaces (Digital input/output DI/O, Analog input/output AI/O, Analogue-to-Digital converters ADC, Counter, Timers, Serial communications interfaces, PWM, UART for USB and LCD functions); Polled and interrupt-driven transfer; and Data buffering. System development tools- simulators and emulators programming. Serial I/O interfacing: I2C, and SPI interfacing and programming. Software Development and Debugging tools. Microcontroller programming in a high-level language. Integration between microcontroller and external devices. Introduction to embedded systems. Lab-based project to involve PIC18/PIC32-based microcontroller development board, electronic assembly, and fault finding.

EEE 453 Control Systems I
(2 Units)

Nature and use of automatic control; concept and purpose of feedback; servomechanism control and regulatory control. Description of simple control systems – servomotors, tachogenerators, error detectors, amplifiers, actuators, valves. Open-loop and closed-loop control system, system specifications. Mathematical models – differential equations, state-space models and transfer function model. Transfer function model of simple electrical, mechanical, pneumatic, hydraulics, and thermal systems. Block diagram algebra – reduction techniques and signal flow graphs. Simulation of dynamics systems. Controllability. Observability. System types.

Effects of feedback. Sensitivity. Time response analysis: transient response to test input signals, steady-state errors, stability analysis, Routh-Hurwitz criterion, root-locus techniques, time-domain performance criteria. Frequency-response analysis: Bode plots, Nyquist plots, bandwidth, resonant peak, gain and phase margins, non-minimum phase systems, inverse responses, Nyquist criterion, Hall charts and Nichols chart, frequency-domain performance criteria. Classical vs modern control design techniques, bang-bang control, pole placement, PID control, IMC control, ratio control, cascade control, introduction to non-linear systems. Detailed use of MATLAB-SIMULINK for analysis and design.

EEE 455 Electrical Power Principles
(3 Units)

Introduction to power systems and sources of electric energy, structure of electric system, load characteristics, electric energy transmission and distribution, line impedance, representation and per unit systems, relationship between currents and voltage; regulation of voltage, transmitted power and losses; construction of overhead lines and underground cables; power system equipment: standard and safety. Power Systems Automation: Introduction to Smart Grid. The electric power grid: classical versus smart grid; components of smart grid. Automation: generation control; substation automation; feeder automation; distribution automation; communication systems/protocol; cybersecurity and challenges of the smart grid.

EEE 457 Communication Principles
(3 Units)

Amplitude modulation; double sideband, single sideband and vestigial sideband modulation schemes; simple modulators, power and bandwidth performance. Angle modulation (frequency modulation, phase modulation), bandwidth requirements. Transmitter circuits. Receiver circuits. Clippers. Limiters. Amplitude modulated signal reception; discrimination, frequency tracking loop, phase locked loop and noise performance. Commercial radio systems. Transmission media; attenuation in open space, air, cable and fibre channels; fibre optics; construction of cables and fibres, sampling theorem, pulse amplitude modulation, pulse width modulation, multiplexing, quantization systems, pulse-code and delta modulation, courses and correction of errors in PCM and DM.

EEE 459 Introduction to Machine Learning
(3 Units)

Principles, algorithms, and applications of machine learning from the point of view of modeling and prediction; supervised learning, unsupervised learning, reinforcement learning; formulation of learning problems; representation, over-fitting, classification, regression, multilayer perceptrons, clustering, association; generalization and methods such as linear classifiers, feed-forward, convolutional, and recurrent networks. Neural Networks: Definition and classification of artificial neutral networks (ANN). Classification of ANN. Terminologies: input/output sets, weights, bias or threshold, supervised learning, network training, convergence process, single layer vs. multilayer perception, forward and backward

propagation, gradient descent rule. Back-propagation neural network, variable term used in back propagation neural network: learning rate, momentum, hidden nodes, sigmoid activation function. Back propagation algorithm of ANN. Design of ANN model, training sets for ANN, test sets for ANN, network testing and performance. ANN programming & applications. Design Project.

EEE 461 Electrical & Electronics Laboratory
(1 Unit)

Laboratory investigation and report submission for selected experiments in electronics, communication, power and machines. A 1-hour pre-lab class session must be taken at the laboratory venue before the 3-hour practical at least a day before the 3-hour practical. A 75% attendance at this 1-hour class session is compulsory to pass the course.

EEE 551 Digital Signal Processing
(3 Units)

Introduction: Advantages of digital over analogue signal processing, problems of digitization, overview of application of DSP, basic elements of DSP system. Discrete-time signals & systems: discrete-time sequences (signals), classification and determination of discrete-time system, difference equations and solutions, convolution, correlation, impulse response. Digital processing of analogue signals: sampling of analogue signals, sampling theorem, aliasing, quantization, noise, and coding, types and selection of ADC/DAC, Sigma-delta ADC. Analytical tools: z-transform, properties, transfer function, inverse z-transform, z-plane poles and zeros, analysis of linear time-

invariant in z-domain, system stability. Discrete Fourier Analysis: Discrete Fourier Transform (DFT) and properties, inverse DFT, truncated Fourier transform, windowing, FFT algorithms. Digital Filters: Definition and types, structure and design. FIR filters: Transfer function, characteristics, applications, design methods, Gibb's effect and elimination, FIR filter realization. IIR filter: Transfer function, characteristics, applications, overview of analogue filter design techniques, design methods-conversion from analogue to digital filter design techniques, IIR filter realization. Structure of Discrete Time System: Block diagram representation of constant coefficient difference equations, IIR and FIR systems and their basic structures, stability of discrete time systems. Software implementation of DSP algorithms including signal compression and spectral analysis. DSP Microprocessors: Architecture, fixed point versus floating point DSP, Finite word length effects. DSP chips: interfacing and programming. Practical application of DSP in audio and video applications.

EEE 552 Reliability & Maintainability of Electrical Systems (2 Units)

Introduction to reliability, maintainability, and metrics. Application to computer hardware systems, communication equipment and power systems and electronic components. Basic maintenance types. Fault troubleshooting techniques. QoS and time of availability of data communication. Quality control techniques. Design of higher reliability and fault tolerance. Software reliability: Specification, and metrics. Programming for reliability, software safety and hazard analysis. Comparison of hardware and software reliability. Software quality and

assurance. Software quality metrics. Ensuring quality and reliability. Verification and Validation, measurement tracking and feedback mechanism, total quality management, and risk management

EEE 553 Power Electronics & Drives
(3 Units)

Switching characteristics of diodes, transistors, thyristors etc. Analysis of diode circuits with reactive loads, analysis of circuits using transistors as switches, power control circuits. Power rectifiers. Characteristics of switching transformers. Power semi-conductor device protection. DC-AC Inverters, DC-DC converters, chopper circuits (one, two and four-quadrant), examples of power electronic circuits, solar devices**.** Characteristics and industrial applications of thyristors devices – SCR, TRIACs, DIACs, GTO, UJT. Protection of semiconductor devices - snubber circuits, etc. Uncontrolled and phase-controlled AC and DC converters and their applications in motor drives, speed control, power supplies, heating and lighting. Transducers and their applications in sensing light, voltage pressure, motion, current temperature, displacement, velocity, power factor and reactive power etc. Mechanical relays, solid-state relays and stepping motors. Electric drive systems: classification and applications. Adjustable speed DC and AC motor drives. Elements of a typical drive system and their configuration including: power electronic converters; 4-quadrant operation; energy recovery; dump resistor sizing; sensing; protection; switchgear; speed control of electric drives; motor power rating; selection and load diagrams. Drive specification and selection. Drive system design for torque and

speed control. DC motor control: braking of DC motors, thyristor phase-controlled converters, Ward-Leonard system. Induction motor control. Variable frequency AC motor drives. Analysis of steady-state characteristics of commonly used industrial drives. Modelling and simulation of electric drive systems. Modulation strategies for power converters. Supervisory (e.g. torque, speed, position) control algorithms: MATLAB-SIMULINK, microcontroller and DSP-based implementation.

EEE 554 Electrical Services Design
(3 Units)

Lighting installation, power installation, energy supply and distribution, choice of cables and conductors, wiring systems and accessories, outdoor low-voltage lines and cables, protection of low voltage installation, and characteristics of low-voltage equipment, Earthing and testing of electrical installation, illumination. Basic electrical installations. Distribution system. Regulation-IEE, NSE, Nigeria standard. Illumination. Electrical installation materials, cables, junction box, terminations, joints and conduits. Cables-types, ratings, wiring systems, earth protection. Auxiliary electrical system-Fire alarm, telephone, elevator circuit. Design of electrical installation - Domestic, industrial, commercial. Air-conditioning systems. Fire suppression and protection systems. Surge and lighting protections. Earthing: earth resistivity measurement, surge and lighting equipment selection and installation. Contract proposal and document preparation. Costing and preparation of BEME. Basic Law of Contract. Commissioning. Environmental Impact

EEE 555 Final Year Project I
(3 Units)

Each student must undertake a project under the supervision of a lecturer, submit a project status report and give two oral presentations by the end of the semester. Each student should attend Engineering seminars.

EEE 556 Final Year Project II
(3 Units)

This course is the continuation of EEE 555. Each student must undertake a project under the supervision of a lecturer, submit a comprehensive project report and give two oral presentations by the end of the semester. Each student should attend Engineering seminars.

EEE 557 Electrical Machines II
(3 Units)

Review of electromechanical energy conversion concepts, and EMF equations. Per-unit (pu) system of calculation. The focus of this course is on three phase machines. Synchronous Machines: construction, equivalent circuit diagram, instability, mathematical representation of salient and non-salient machines, performance characteristics, polar diagram, synchronous generators, 3-phase alternators, synchronous motors. Induction Machines: construction, equivalent circuit diagram, performance characteristics, torque/slip relations, speed control, 3-phase induction generators, single-phase induction motors and applications, universal motors, reluctance motors, hysteresis motors. Introduction to Parks equations. Faults on machines. Short circuit analysis of synchronous

machines, d-q analysis of salient pole machines. Parallel operation of generators. Methods of starting and protection of machines. Practical applications involving electric control panels – contactors, breakers, and other switchgear components.

EEE 558 Microwave and Radar Systems
(2 Units)

Microwave frequencies and uses; microwave transmission in transmission lines and wave guides, microwave circuits; impedance transformation and matching, microwave circuits; passive microwave devices, resonant and filter circuits, active microwave devices; Klystron and magnetron tubes and semiconductor devices for microwave generation. Antennae: definitions of elementary parameters related to radiation patterns; dipole and aperture antennae and the related design parameters; introduction to antennae arrays. Radio wave propagation: propagation in the ionosphere, troposphere and in stratified media; principles of scatter propagation; applications in general broadcast, television and satellite communication systems. Radar systems nature of radar and radar equations; composition of a radar system; application of different types of radars.

EEE 559 Telecommunication Engineering
(2 Units)

Cable telegraphy and telephony characteristics, cross talk, equation, Poleliness, aerial and underground cables. Telegraph systems: codes, radio systems, terminal equipment (teleprinters, relays, switching systems, and repeaters). Telephone receivers,

switching (crossbar, electronic switches), PBX, PABX, Transmission standards, Telephone network structure.

EEE 560 Telecommunication Services Design (2 Units)

Telecommunication Design & Installation: Telephone, Switches, Routers, PABX. Computer Networking: design, calculations, topology, choice of cables and accessories, cabling and trunking, optic fibre installations and accessories. Satellite and VSAT installation. Lightning protection techniques. Earthing techniques. Telecom technologies and equipment. Bill of Engineering material and Evaluation (BEME) of telecommunication installations.

EEE 561 Digital Communications Systems (2 Units)

Block Diagram of digital communication system sampling theorem, Shannon theorem and applications in digital communication system. Advantages of digital signals. Noise in digital system. Filtering and equalisation. Digital modulation techniques: FSK, ASK, QPSK, M-PSK, QAM, etc. Error detection and correction techniques Encoders/Decoders. Applications of digital communication system: Satellite communication, telephoning microwave, wireless communication, optical communication, Broadband. Communication. Internet Technology.

EEE 562 Digital Computer Networks
(2 Units)

Communication within computer systems: addressing and databases. CPU – memory–I/O device communications. Communication between systems: host/host versus host/slave relationships, handshaking protocols and synchronisation. Serial versus parallel communications. Hardware elements of network design – terminals, modem, multiplexors, and concentrators. Message and control processors. Communication equipment and carriers. Software elements of computer networks: host operating systems. Message and packet switching. Structure of computer networks: host operating systems: star, ring, and hierarchical networks. Decentralised networks.

EEE 563 Antenna Theory and Applications
(2 Units)

Antenna Systems: review of Maxwell's equations, antenna design basics, polarization, polar diagrams, antenna gain, directivity, radiation resistance, impedance matching, effective length and capture area. Radiation by dynamic currents and charges, retarded potentials, isotrope. Hertzian dipole, short and loop antenna, folded dipole antenna. Vertical and horizontal antennas, rhombic antenna, log-periodic antenna. Centre-fed linear antenna, linear arrays, radiation from diffraction gratings, Yagi-Uda arrays, integrated antennas. Microwave antenna, horn, parabolic reflectors, slot, and lenses. Field analysis of antennas. Transmitting-receiving system, reciprocity relations. Equivalent circuit of receiving antenna. Radar Systems: Principles of pulse radar and Doppler radar. Radar equation and system parameters. Components of radar systems. Study of a practical radar system.

Radar signal detection. Synthetic aperture radar, tracking and scanning radar, HF (OTR) radar. Radio Wave Propagation: Electromagnetic waves, wavefront, characteristic impedance of free space, reflection, refraction and diffraction. Ground waves and sky waves. The ionospheric layers, refractive index, virtual height, critical frequency and angle, maximum usable frequency, skip zone, skip distance, fading. VHF line of sight transmission. Tropospheric propagation and scattering. Relationship between transmitter power, antenna gains and received signal to noise in a free space radio link. VHF and microwave point-to-point link.

EEE 564 Switchgear and High Voltage Engineering (2 Units)

Generation and measurement of high voltage and current; Breakdown theories for gaseous liquid and solid dielectrics, lightning phenomena, High Voltage equipment, insulation co-ordination, lightning protection, Electric cables and condensers.

EEE 565 Electronic Communications (2 Units)

This course covers the specialized circuits for communication systems. Communications Hardware – mixers, filters, modulator and demodulator circuits, RF Oscillators, high-speed serial link circuits, hybrid circuits. Special communications amplifiers. RF Amplifiers. Tuned amplifiers. Single-ended and differential LC tuned amplifiers. Integrated inductances, active mixers of 2 and 4 quadrants, IP3 point - Variable gain amplifiers (VGA), amplifiers with automatic gain control (AGC). Logarithmic control law. Optical electronic circuits – photodetectors and

lasers. A mini-project to involve design and implementation of simple communication systems.

EEE 566 Renewable Energy
(2 Units)

Energy - past, today and future; energy consumption; energy and environment; natural resource management. Sources of energy (conventional and renewable sources). Waste heat recovery. Fuel Cells. Hydrogen storage. Thermoelectrics. Batteries. Super-capacitors. Effect of environmental factors on energy storage. Electrical energy conversion, Conversion metrics. Performance metrics. Efficiency. Solar energy – basic concepts, solar thermal energy and solar photovoltaics. Wind energy, wind resources, and wind turbines. Bioenergy, biomass, bioelectricity and biofuel. Wave/Tidal energy. Geothermal energy. Hydropower and hydroelectricity. Legislations, economic, technical, and sustainability issues involved in integration of renewable energy sources.

EEE 567 Power Systems Analysis I
(2 Units)

Representation of power systems, power system equation and Analysis, load flow studies, load forecasting, economic operation of power systems, symmetrical components, symmetrical and unsymmetrical faults, various types of relays used in power systems, protection systems of power transmission lines, principles of fault detection, discrimination and clearance, elements of power systems stability.

EEE 568 Power Systems Analysis II
(2 Units)

Review of linear algebra and numerical methods. Iterative methods: Newton-Raphson Method. Gaussian elimination method. Euler method, Runge-Kutta method, Gauss-Siedel method, Node admittance matrix, Load flow analysis. State estimation. Load forecasting technique. Time series, Kalman filter. Use of MATLAB is obligatory.

EEE 569 Power Systems Protection and Control
(2 Units)

Review of transmission line theory. High frequency communication on power lines carrier systems and power-line carrier applications. Multiplexing, Telemetering. Data transmission and signal processing techniques needed for power system protection. Control of power generation, voltage control, system stability, automatic voltage regulators, regulating transformers, protection of motors, electromechanical relays and digital protective relaying. Instrument transformers, current transformer, voltage transformers, protective relays, circuit breakers and fuse. Distance protection, overcurrent, directional overcurrent, differential and pilot protection schemes, etc for fulfilling power system protection. Protocol standards e.g. IEC 61850, IEEE C37.236-2013.

EEE 570 Power Quality Control
(2 Units)

Power quality problems, classification, causes and impact. Voltage control, frequency control, harmonics, power conditioning (electronic filters), smart grid and power quality

EEE 571 Introduction to Mechatronics Design
(2 Units)

Basic instrumentation concepts; Overview of mechatronics and its design approach; Measurement Systems; Control Systems. Microprocessor-based controllers: introduction, hardware overview, programming, interrupts, on-chip subsystems, parallel I/O. Choice of embedded computers (HCS12 and PIC); choice of level of languages: low-level, mid-level, high-level languages. Analog and digital devices: Op-amp, ADC, DAC, and power transistors, H-bridge, relay-bridge. Programming of microprocessors, mechanics prototyping, and the design process. Application of analog and digital electronics to modern mechatronics systems and intelligent manufacturing particularly smart sensors, controllers and actuators. Stepper motor controller and driver. Serial communication, analog I/O, PWM, interfacing communication with PC. Modelling and control of electromechanical systems: actuators (solenoids, solid-state witches, DC motors, stepper motors, servomotors, AC motors), sensors (position, velocity, force, tactile, pressure, level, and ultrasonic), and their applications to intelligent manufacturing. Analog and Digital Sensors. Encoders. Electric motors, actuators, and sensor integration, motion control, and mechanical drives. Pneumatic and Hydraulic Systems: directional control valves, rotary actuators. Mechanical Actuation Systems: cams, gear trains, ratchet and pawl, belt and chain drives, bearings. Introduction to CNC Programming. Introduction to Programmable Logic Controller (PLCs). Introduction to design of robotic systems.

EEE 572 Robotics
(2 Units)

Introduction to robots, classification, and their applications. Design of robotics applications. Robot configurations; end effectors, sensors, safety; Power transfer devices. Components for mobility of a robot. Robot kinematics and dynamics: co-ordinate systems and kinematic transformations; joints and links; direct and inverse kinematics, kinematic analysis of robot manipulators. Actuators (dynamics of drive systems, stepper motors, permanent magnet and brushless DC motors) and sensors (position and velocity sensing devices). Co-ordinate transformation. Various mechanical configurations for robot manipulators, robot control systems, global sensing of robotic systems and their safety implications. Design and selection of typical motors used for robotic actuation. Workspace analysis, control, and trajectory planning. Drive motion profiles. CAD modelling of robotic systems. Differential motion and statics. Manipulator dynamics end-of arm tooling, automation sensors. Robot vision. Work-cell support systems. Robot and system integration. Safety. Human interface. Robot control system. Circuit and system configuration. Task oriented control, industrial robot standard, interface devices and systems, software interfaces, robot control programming. AI and Fuzzy logic-based robot control. Robot applications.

EEE 573 Advanced Electronic Circuits
(2 Units)

Review of Class A, AB, B, C amplifiers, push-pull amplifiers. Sample-and-hold (S/H) circuit design. Analysis and design of S/H amplifiers, integrated operational amplifiers, and advanced

circuits such as wide-band amplifiers and instrumentation amplifiers. Low and high-power RF amplifier design techniques. Design techniques for advanced analogue circuits containing transistors and operational amplifiers. Analog-to-Digital converters (ADCs), Digital-to-Analog Converters (DACs), analysis and design of crystal oscillators, LC oscillators, voltage-controlled oscillators, Hartley oscillators, Colpitts oscillators, opto-electronic oscillators, tuneable-frequency oscillators, phase-locked loops. Simulation using software tools e.g. PSPICE, Visio, Proteus should be encouraged.

EEE 574 Modern Control Engineering
(2 Units)

Review of state-space concepts, eigenvalues and eigenvectors. State-Space realizations; state transition matrix; controllability and observability; canonical transformation and Cayley-Hamilton theorem. Controller design: state feedback control, state estimation and observer design. Pole placement using state feedback and output feedback control. Ackermann's formula, stability analysis of state-space systems, Pontryagin's maximum principle, tracking control: reference input, Controllers with integral action. Introduction to optimal control, Kalman filter, LQR, and LQG. Nonlinear control. Linearization – Jacobi, feedback, input-output linearization. Phase planes, phase portrait and limit cycles. Lyapunov stability. Describing function method. Introduction to adaptive control. Detailed use of MATLAB-SIMULINK for analysis and design.

EEE 575 Control Systems II
(2 Units)

Introduction of case study practical examples for this course. Feedback control and sensitivity, design in a frequency domain framework, lead-lag compensator design, H-infinity loop-shaping control design. Digital control: elements of digital control systems; review of discrete signals and difference equations; s-domain to z-domain mapping, and Z-transforms. Dynamic analysis of discrete-time systems, ADC/DAC and sample-and-hold circuits, concept of sampling, sampled-data system, Nyquist–Shannon sampling theorem, Z-plane stability analysis using Jury's methods and bilinear transformation; pole placement design, discrete IMC, discrete PID control. Implementation of digital controllers. Design Project - microcontroller and microprocessor-based control systems implementation for mechatronics/robotics case study. Detailed use of MATLAB-SIMULINK for analysis and design.

EEE 576 Embedded Systems Design
(2 Units)

Structural level modelling, Register-Transfer level modelling, Finite state machine (FSM) with data path level modelling, and algorithmic level modelling. Introduction to ASICs, Types of ASICs, ASIC design process, Standard cell ASIC synthesis. Introduction to FPGA Design, Paradigm, FPGA synthesis, FPGA/CLPD Architectures, Introduction to VHDL: language, design. Concurrent VHDL, Sequential VHDL, and advanced features. VHDL Design: Top-down design flow, Verification, Writing RTL VHDL code for synthesis and top-down design with FPGA. VHDL synthesis, optimization and mapping,

constraints, technology library, delay calculation, synthesis tool and directives. Computer-aided design of logic circuits.

EEE 577 Sensors, Actuators and Instrumentation (2 Units)

Methods and technology used in automation, mechatronic and robotics industries. Mechanical components and complements material on control systems, sensors and actuators. Principles of operation of the main types of sensors. Merits and demerits of various types of sensors for a wide range of applications. Limitations in the performance of instrumentation systems. Selection of appropriate sensors for a given application. Design simple electronic sensor interface systems. Components selection for instrumentation systems. Actuators (dynamics of drive systems, stepper motors, PM and brushless DC motors) and sensors (position and velocity sensing devices). Sensors and actuators: characteristics and specifications. Instrument Converters: signal conditioners, voltage-to-current converters, voltage-to-frequency converters, current-to-voltage converters, and frequency-to-voltage converters – principles of conversion and dedicated ICs. Instrumentation Amplifiers: floating and grounded loads. Isolation Circuits: general concepts, transformer-coupled amplifiers, optically-coupled amplifiers. Cabling: magnetic shielding, electrostatic shielding, and grounding. Integrated instrumentation systems. Piping/Process and Instrumentation diagram (P&ID) diagrams, instrument calibration, hydraulic systems, gas and liquid flow calculations, distributed control systems (DCS), supervisory control and data acquisition (SCADA).

OLD CURRICULUM FOR 400 AND 500 LEVEL

LIST OF COURSES

400 LEVEL

1st Semester

Course Code	**Course Title**	**U**	**ST**	**L**	**T**	**P**
GNE 415	Engineering Analysis	3	C	2	1	-
EEE 411	Communication Principles	3	C	2	1	-
EEE 413	Antenna & Propagation	3	C	2	1	-
EEE 415	Electric Power Systems Engineering Principles	3	C	2	-	3
EEE 417	Prototyping techniques	2	C	1	-	3
EEE 419	Computer Systems Engineering	3	C	2	-	3
EEE 421	Electrical/Electronic Laboratory	1	C	-	-	3
EEE 425	Renewable Energy	2	C	2	-	-
Total		**20**				

400 LEVEL

2nd Semester

Course Code	**Course Title Students' Industrial Work Experience Scheme**	**U**	**ST**	**L**	**T**	**P**
EEE 402	SIWES - Industry-Based Supervisors assessment	4	C	-	-	-
EEE 404	SIWES - University Supervisor's Assessment	4	C	-	-	-
EEE 406	SIWES - Student's Report & Seminar Presentation	4	C	-	-	-
Total		**12**				

500 – LEVEL (Electrical & Electronics Engineering Programme)

1st Semester

Course Code	**Course Title**	**U**	**ST**	**L**	**T**	**P**
GNE 501	Engineering Economics	3	C	2	1	-
EEE 511	Reliability & Maintainability of Electrical Systems	2	C	2	-	-
EEE 513	Advanced Computer Programming & Statistics	3	C	2	1	-
EEE 515	Control Engineering	3	C	2	-	3

EEE 517	Advanced Circuit Techniques	2	C	2	1	-
EEE 519	Digital Signal Processing	3	C	2	1	-
EEE 521	Solid State Electronics	2	C	2	-	-
	Electives (3 courses)	6	E			
Total		**24**				

Electives: Students are required to take a minimum of four units from any of the optional courses:

Course Code	Course Title	U	ST	L	T	P
EEE 531	Introduction to Nanotechnology	2	E	2	-	-
EEE 533	Power Electronics & Devices	2	E	2	-	-
EEE 535	Switchgear & High Voltage Engineering	2	E	2	-	-
EEE 537	Microcomputer Hardware & Software Techniques	2	E	2	-	-
EEE 539	Telecommunication Engineering	2	E	2	-	-

2nd Semester: Electrical & Electronics Engineering Option

Course Code	**Course Title**	**U**	**ST**	**L**	**T**	**P**
GNE 502	Engineering Management	3	C	2	1	-
EEE 524	Digital Communications System	2	C	2		-
EEE 526	Industrial Electronic Design	2	C	2	-	-
EEE 528	Power Systems Engineering	3	C	2	-	3
EEE 530	Electrical Services Design	2	C	2	-	-
EEE 532	Object Oriented Design & Programming	3	C	2	-	3
EEE 590	Project	6				
EEE 598	Seminar	1	C	-	-	-
	Electives (1 Courses)	2	E			
Total		**24**				

Electives: Students are required to take a minimum of six units from any of the optional courses

Course Code	Course Title	U	ST	L	T	P
EEE 534	Power Systems Communication & Control	2	E	2	-	-
ECE 526	Robotic & Automation	2	E	2	-	-
EEE 536	Communication Systems	2	E	2	-	-
EEE 538	Analogue & Digital Computer	2	E	2	-	-
EEE 540	Telecommunication Services Design	2	E	2	-	-

GNE 415 Engineering Analysis
3 Units

Complex variables – advanced topics, differentiation and integration of complex functions. Cauchy – Riemann equations: Related theorems. Laplace and Fourier transforms – Applications: Introduction to non-linear differential equations – stability and 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.

EEE 411 Communication Principles
3 Units

Amplitude modulation; double sideband, single sideband and vestigial sideband modulation schemes; simple modulators,

power and bandwidth performance. Angle modulation (frequency modulation, phase modulation), bandwidth requirements, clippers and limiters. Amplitude modulated signal reception; discrimination, frequency tracking loop, phase locked loop and noise performance. Commercial radio systems. Transmission media; attenuation in open space, air, cable and fibre channels; construction of cables and fibres, sampling theorem, pulse amplitude modulation, pulse width modulation, multiplexing, quantization systems and pulse code modulation, delta modulation, courses and correction of errors in PCM and DM.

EEE 413 Antenna & Propagation
3 Units

Antenna Systems: Review of Maxwell's equations. Polarization, polar diagrams, antenna gain, directivity, radiation resistance, impedance matching, effective length and capture area. Radiation by dynamic currents and charges, retarded potentials, the isotope. Hetzian dipole, short and loop antenna, folded dipole antenna. Vertical and horizontal antennas, rhombic antenna, log-periodic antenna. Centre-fed linear antenna, linear arrays, radiation from diffraction gratings, Yagi-Uda arrays, integrated antennas. Microwave antenna, horn, parabolic reflectors, slot, lenses. Field analysis of antennas. Transmitting-receiving system, reciprocity relations. Equivalent circuit of receiving antenna. Radar Systems: Principles of pulse radar and Doppler radar. Radar equation and system parameters. Components of radar systems. Study of a practical radar system. Radar signal detection. Synthetic aperture radar, tracking and scanning radar, HF (OTR) radar. Radio Wave Propagation:

Electromagnetic waves, wavefront, characteristic impedance of free space, reflection, refraction and diffraction. Ground waves and sky waves. The ionospheric layers, refractive index, virtual height, critical frequency and angle, maximum usable frequency, skip zone, skip distance, fading. VHF line of sight transmission. Tropospheric scattering communications. Relationship between transmitter power, antenna gains and received signal to noise in a free space radio link. VHF and microwave point-to-point link.

EEE 415 Electric Power Systems Engineering Principles
3 Units

Introduction to power systems and sources of electric energy, structure of electric system, load characteristics, electric energy transmission and distribution, line impedance, representation and per unit systems, relationship between currents and voltage; regulation of voltage, transmitted power and losses; construction of overhead lines and underground cables; power system equipment: standard and safety.

Power Systems Automation: Introduction to Smart Grid. The electric power grid: classical versus smart; components of smart grid. Automation generation control; substation automation; feeder automation; distribution automation; communication systems/protocol; cybersecurity and challenges of the smart grid.

EEE 419 Computer Systems Engineering
3 Units

This course covers topics on the engineering of computer software and hardware systems: techniques for controlling

complexity; strong modularity using client-server design, virtual memory, and threads; networks; atomicity and coordination of parallel activities; recovery and reliability; privacy, security, and encryption; and impact of computer systems on society. Case studies of working systems and readings from the current literature provide comparisons and contrasts. Two design projects are required, and students engage in extensive written communication exercises.

EEE 421 Electrical/Electronic Laboratory
2 Units

Practical work on various aspects of electrical/electronic

EEE 423 Software Development Techniques
2 Units

Software development life cycle. Top-Down design. Program, design using pseudo-code, flowchart. Flowchart ANSI symbols and usage. Extensive examples, and exercises using pseudo-code/flowchart to solve practical problems in engineering. Debugging and documentation techniques. Programming using a structural language such as C: Symbols, keywords, identifiers, data types, operators, various statements, operator precedence, type conversion, conditional and control structures, function, recursive functions. Arrays: 1-D, and multi-dimensional arrays, passing elements or whole array to a function. Simple sorting and searching on arrays, pointers, strings, dynamic memory allocation. Structures and Unions: Structure declaration and definition, accessing structures, array of structures, pointers and structures, union declaration, enumerated variables. File Handling: Concept of a file, files and streams, standard file

handling functions, binary files, random access files. Advanced Topics: Command line parameters, pointers to functions, creation of header files, stacks, linked lists, bitwise manipulation. Software development in C in MS Windows, UNIX/LINUX environments, header file, preprocessor directives, make, makefile. Static and dynamic linking libraries. Extensive examples, and exercises programming in C to solve practical problems in engineering. Exercises are to be done in the Computer Laboratory.

EEE 524 Digital Communications System
3 Units

Block Diagram of digital communication system sampling theorem, Shannm theorem and applications in digital communication system. Advantages of digital signals. Noise in digital system. Filtering and equalisation. Digital modulation techniques: FSK, ASK, QPSK, M-PSK, QAM, etc. Error detection and correction techniques. Encoders/Decoders. Applications of digital communication system: Satellite communication, telephoning microwave, wireless communication, optical communication, Broadband. Communication. Internet Technology.

EEE 425 Renewable Energy
2 Units

Energy - past, today and future; history of energy consumption, energy and environment; solar Energy - sun and its energy, basics of solar energy, solar energy in the past, solar thermal energy and solar photovoltaic; wind energy - historical

background, wind resources, wind turbines and environmental impact; biomass – bioelectricity and biofuel.

EEE 526 Industrial Electronics Design
2 Units

Characteristics and industrial applications of thyristors and other SCR devices. Transducers and their applications in sensing light, voltage pressure, motion, current temperature, etc. Mechanical relays, solid state relays and stepping motors. Real time control and remote control concepts in instrumentation. Micro-processor and micro-computer based systems. Fire alarms, burglar alarms and general home and industrial instrumentation.

EEE 528 Power Systems Engineering
3 Units

Representation of power systems, power system equation and Analysis, load flow studies, load forecasting, economic operation of power systems, symmetrical components, symmetrical and unsymmetrical faults, various types of relays used in power systems, protection systems of power transmission lines, principles of fault detection, discrimination and clearance, elements of power systems stability.

EEE 530 Electrical Services Design
2 Units

Lighting installation, power installation, energy supply and distribution, choice of cables and conductors, wiring systems and accessories, outdoor low voltage lines and cables, protection of low voltage installation, and characteristics of low voltage

equipment, Earthing and testing of electrical installation, illumination.

EEE 531 Introduction to Nanotechnology
2 Units

Nanotechnology is the engineering of functional systems at the molecular scale. This course attempts to explain what nanotechnology is and why is it important? Manipulation of physical and chemical properties change of atoms. Constructing electronic, telecommunication circuits at nanoscale: nanomaterials, nanoelectronics and MEMS (micro-electro-mechanical systems) devices. Benefits of nanotechnology.

EEE 532 Object-Oriented Design and Programming
3 Units

Basic Object-Oriented Programming (OOP) concepts: Classes, Objects, inheritance, polymorphism, Data Abstraction, tools for developing. Compiling, interpreting and debugging, Java programs, Java syntax and data objects, operators. Central flow constructs, objects and classes programming, Arrays, methods. Exceptions, Applets and Abstract, OLE, Persistence, Window Toolkit. Basic engineering circuits' design using OOP.

EEE 533 Power Electronics and Devices
3 Units

Switching characteristics of diodes, transistors, thyristors etc. analysis of diode circuit with reactive loads, analysis of circuits using transistors as switches, power control circuits, ACDC converters, characteristics of switching transformers, power

semi-conductor device protection, examples of power electronic circuits, solar devices**.**

EEE 534 Power System Communication and Control
2 Units

Review of transmission line theory. High frequency communication on power lines carrier systems and power line carrier applications. Multiplexing, Telemetering, Signal processing and data transmission. Control of power generation, voltage control, system stability, automatic voltage regulators, regulating transformers.

EEE 535 Switchgear And High Voltage Engineering
2 Units

Generation and measurement of high voltage and current; Breakdown theories for gaseous liquid and solid dielectrics, lightning phenomena, High Voltage equipment, insulation co-ordination, lightening protection, Electric cables and condensers.

EEE 536 Communications Systems
3 Units

Microwave frequencies and uses; microwave transmission in transmission lines and wave guides, microwave circuits; impedance transformation and matching, microwave circuits; passive microwave devices, resonant and filter circuits, active microwave devices; Klystron and magnetron tubes and semiconductor devices for microwave generation. Antennae: definitions of elementary parameters related to radiation patterns; dipole and aperture antennae and the related design

parameters; introduction to antennae arrays. Radiowave propagation: propagation in the ionosphere, troposphere and in stratified media; principles of scatter propagation; applications in general broadcast, television and satellite communication systems. Radar systems nature of radar and radar equations; composition of a radar system; application of different types of radars.

EEE 537 Micro-Computer Hardware And Software Techniques 2 Units

Elements of digital computer design; control unit, micro-programming, bus organisation and addressing schemes. Micro-processors, system architecture, bus control, instruction execution and addressing modes. Machine codes, assembly language and high-level language programming, Micro-processors as state machines. Microprocessor interfacing: Input/output. Technique, interrupt systems and direct memory access; interfacing to analogue systems and applications to D/A and A/D converters. System development tools: simulators, EPROM programming, assemblers and loaders, overview of available microprocessor application.

EEE 538 Analogue And Digital Computer 2 Units

Analogue computation, electrical analogue of mechanical, electromechanical systems and servomechanisms. Analogue computer elements: potentiometers, operational amplifiers, function generators, simulation of system transfer functions. Digital computer structure and elements, CPU, storage, peripherals Arithmetic processes, Hybrid computer systems.

EEE 539 Telecommunication Engineering
2 Units

Cable telegraphy and telephony characteristics, cross talk, equation, Pole lines, aerial and underground cables. Telegraph systems: codes, radio systems, terminal equipment (teleprinters, relays, switching systems, repeaters). Telephone receivers, switching (crossbar, electronic switches), PBX, PABX, Transmission standards, Telephone network structure.

EEE 540 Telecommunication Services Design
2 Units

Telephone installations, PABX installations choice of cables and accessories, computer networking: choice of cables, installations, accessories, optic fibre installations and accessories. Lighting protection techniques. Earthing techniques. Bill of Engineering material and Evaluation and billing of telecommunication installations.

EEE 590 Final Year Project
6 Units

This course lasts for one academic session. Each student must undertake a project under the supervision of a lecturer, submit a comprehensive project report and present a seminar at the end of the year. A project status report is to be presented at the end of the first semester. Each student must attend Engineering Seminars.