SOFTCORE UNIVERSITY

FACULTY OF ENGINEERING SCIENCES AND TECHNOLOGY

School of Electrical and Electronic Engineering

Regulations and Syllabus for the Degree

of

Bachelor of Engineering

in

Electrical and Electronic Engineering

APPROVED BY SENATE

2017

Table of Contents

GENERAL INFORMATION

1.1 Vision

To be a top rated University of Technology

1.2 Mission

To provide technological education and training and to contribute towards the advancement of society through research and innovation.

1.3 Philosophy of the University

The Softcore University of Kenya is founded on the belief that economic development of a nation is achievable fundamentally through technological advancement. Such technological progress is feasible through a strong industrial base, which enhances the production of competitive goods and services for both the local and external markets. Industrialization requires a critical mass of personnel with requisite technical skills. In order to produce these personnel, the training and education must be of a practical nature and anchored on solid theoretical foundations. In this regard, The Softcore University of Kenya is a centre of excellence for the training of personnel in technological, creative, business and management skills. The institution plays a leading role in the economic development of Kenya by imparting skills that are appropriate to the real world of work, even as it aims to produce holistic graduates with the flexibility to fit into the demands of a constantly changing world.

1.4 University Admission Requirements

Minimum University Entrance Requirement

An applicant must satisfy any of the following minimum requirements for admission to all Bachelor's degree programmes. Either

(i) Be a holder of Kenya Certificate of Secondary Education (or equivalent examination) certificate with a minimum aggregate of C+; Or

(ii) Be a holder of Kenya Advanced Certificate of Education (or equivalent examination) certificate with a minimum of two principal passes and one subsidiary pass; Or

(iii) Be a holder of a diploma or professional certificate in a relevant discipline from an institution recognized by the Senate of the University; or

(iv) Be a holder of any other qualification accepted by the Senate of the University as equivalent to any of the above. Candidates who hold any of the qualifications (iii) or (iv) above may, at the discretion of the Senate, be exempted from some courses.

Exemption from any Courses in the Programme

(a) The point of entry into the programme for candidates with qualifications other than KSCE, A-Levels, shall be approved by Senate on the recommendations of the Academic Board of the Faculty of Engineering Sciences and Technology, and shall be based on the qualifications of the applicant.

(b) Where a candidate wishes to be exempted from any course or courses of study, such candidate shall make a written formal application to the Registrar (Academic) justifying the request and attaching evidence of the credentials which support such request. Such a candidate may be required to sit and pass an exemption examination set and administered by the School and approved under the authority of the Senate on the recommendation of the Faculty Academic Board.

(c) Based on the assessment of the exemption examination, the Academic Board of the School of Electrical and Electronic Engineering shall make its recommendation to the Faculty Academic Board. On approval of such recommendation by the Faculty Academic Board, the Board shall forward its recommendation to Senate for further consideration. The decision of the Senate shall be communicated to the Faculty Academic Board who in turn shall communicate the decision to the candidate.

1.5 Procedure of Application for Admission

When the University advertises the program, applicants shall be expected to;

i. Apply to be considered for admission

ii. Attach certified copies of undergraduate degree certificate and transcripts

iii. Ask for letters of reference from at least two referees

iv. Attach a copy of bank-in slip for application fee

1.6 Academic Resources

1.6.1 FACILITIES AND EQUIPMENT

Item	**Number**	**Capacity**	**Usage**	
			Specific to Department	**Shared**
Lecture Rooms	4	20	4	Yes
Seminar Room	1	20	1	Yes
Lecturer's Offices	3	6	3	Yes
Laboratories - Machines Lab. -Power Systems Lab - Control Lab -Power Electronics Lab	 1 1 1 1	 20-100 20-100 20-100 20-100	 1 1 1 1	 Yes Yes Yes Yes
Workshops	1	20-100	1	Yes
WiFi Router	4	20-100	1	Yes
Internet Access Points	10	20	10	No
Others- library sitting space	1	500 per seating	-	Yes

1.6.2 EQUIPMENT AND TEACHING MATERIALS (FOR THE DEPARTMENT)

Item	Type	Number	Capacity	Usage	
				Specific to Department	Shared
Computers (PCs)	Dell	10	20	10	Yes,
Lap Tops	HP/ Toshiba	4	20	4	Yes
LCD Projectors	Sony	4	20	4	0
Computer Software	PSAT OCTAVE	20 20	20 20	20 20	Yes Yes

1.6.3 ACADEMIC STAFF

S/NO	NAME	PROFFESIONAL QUALIFICATION	Designation
1	PROF. DOMINIC B. O KONDITI	PhD, PostDoc.Res, M.Eng, Pre-MSc Cert., H.Dip	Full Professor
2	PROF. STEPHEN MUSYOKI	PhD, M.Eng, B.Eng	Associate Professor
3	DR. CHRISTOPHER M. MURIITHI	PhD, M.Sc, B.Sc	Senior Lecturer
4	PETER J. MIANO	M.Sc H.Dip	Lecturer
5	JOSEPH M. KARANJA	M.Sc, B.Sc(Elec)	Assistant Lecturer
6	JOSEPH ABOK	M.Sc, B.Sc(Elec)	Assistant Lecturer
7	SAMUEL K. CHEGE	M.Sc,BPhil, H.Dip	Technologist
8	ANTONE MUBINYA	Mtech, B.Tech, H.Dip	Lecturer
9	WINSTONE O. OJENGE	M.Sc, B.Ed.Tech	Lecturer
10	JACOB MUSEMBI	MS.c, B.Ed	Lecturer
11	BENARD MUTAI	M.Sc (Electronics)	Lecturer
12	JOHN B. MWANZA	Mphil, B.Ed.Tech	Assistant Lecturer
13	ALFRED ORERO	M.Sc, B.Sc (Elec)	Tutorial Fellow
14	RITA LAIBUTA	M.Sc, B.Sc (Elec)	Tutorial Fellow
15	BILL MAKAYOTO	B.Sc (Elec)	Tutorial Fellow
16	LONAH SEGERA	BSc (Elec)	Graduate Assistant
17	DICKSON G. WAMBAA		Assistant Lecturer

18	GORDON O. AGUTU		Tutorial Fellow
19	STEVEN OMONDI		Tutorial Fellow
20	FLORENCE CHELANGAT		Graduate Assistant
21	MARGRET K. GECHANGA		Graduate Assistant
22	DANIEL E. WEKESA		Graduate Assistant

1.6.4 Programs Offered

a) List of programs

i. Bachelor of Technology: Electrical and Electronic Engineering Technology

ii. Bachelor of Philosophy: Electrical and Electronic Engineering Technology

iii. Bachelor of Engineering: Electrical and Electronic Engineering

b) Definitions of:

i. Credit hours – the total hours required for the program

ii. Lecture hours – physical hours that each lecture takes

iii. Contact hours – hours that the lecturer and student work together

iv. Course units – titles of study for each program

c) The program shall be organized in semesters and the academic year set as follows:

1st semester – September to December

2nd semester – January to April

3rd semester – May to August shall be dedicated to activities such as research, industrial based learning (IBL) and academic trips.

THE CURRICULUM

1.7 Title of the Program

The program of study is **Bachelor of Engineering in Electrical and Electronic Engineering**

1.8 Philosophy of the Programme

The philosophy of Softcore University of Kenya is founded on the belief that economic development of a nation is achievable fundamentally through technological advancement. As such, the school of Electrical and Electronics Engineering strives to produce personnel with requisite technical skills applicable in all engineering sectors. The training and education is of a practical nature and anchored on solid theoretical foundations. In this regard, the aim of the

degree of Bachelor of Engineering in Electrical and Electrical Engineering is to produce electrical engineers having strong theoretical foundation, good design and practical experience and exposure to project development and implementation. This course plays a leading role in the economic development of Kenya by imparting skills that are appropriate to industries, internationally and locally, even as it aims to produce holistic graduates with the flexibility to fit into the demands of a constantly changing world.

1.9 Rationale of the Programme

An Electrical Engineer will be competent to design, implement and control production, testing, planning, construction, commissioning and maintenance in the field of Electrical Engineering by applying technical knowledge, engineering principles, innovative design, problem-solving techniques and managerial skills. He/she will be capable of exercising independent technological judgement and responsible decision making by taking into account the relevant financial, economic, commercial, social, environmental and statutory factors.

On completion of this degree, the student will have met the academic requirements of technical expertise which are in alignment with Vision 2030 core priorities for the 2nd Medium Term Plan. The degree gives the Graduates the ability to find solutions to practical engineering problems by applying proven techniques and procedures. The graduates may also be responsible for technical decision making. This career route offers challenging work in all areas of electrical engineering.

Vision 2030 recognizes the need to alter the structure of the Kenyan economy to take advantage of global opportunities as well as meet the needs of the Kenya's growing population. Science, Technology and Innovation are areas of significant potential that have been identified under Vision 2030, which will play a fundamental role in achieving the targeted benefits of the long term plan.

It is a major achievement for the Softcore University to be one of the only two public universities in the country offering a Bachelor of Technology in Electrical Engineering. This

program offers collaboration between education and training institutions, on one hand, and industry, on the other hand, including a comprehensive framework for industrial attachment and apprenticeship system.

2.3.1 Needs assessment/ market survey/ Situation Analysis

In line with the Vision 2030 focus on training in the science and technology areas in particular, with the aim of achieving the Sustainable Development Goals (SDGs), the Bachelor of Technology Program is expected to nurture creativity, critical thinking, and produce innovative and adaptive human resources with appropriate skills, attitudes and values for wealth creation, employment and prosperity.

The programme provides an opportunity for the students who have qualified with a Degree in Engineering from TUK and other universities advance their studies to degree levels. This increases their employability and builds relevant skills for Industrial Development within the country. It also prepares entrepreneurship for self-reliance therefore adding to the economic growth of Kenya.

Additionally, the mandatory Industrial Based Internship program structured within the syllabus ensures that the course is hands – on, competency based, market-driven and addresses the needs of the workplace as well as promoting employability, soft, generic and life skills in partnership with private sector and professional bodies. It also improves collaboration between industry, professional bodies and the university in determining competences of the graduates. As such, graduates are easily assimilated into relevant industries immediately after graduation as Professional Engineers.

2.3.2 Justification of the Program

The programme prepares the candidates to function as engineers. The electrical engineer is trained in preparing designs for **the art of production of artefacts, structures, and systems** to be implemented by electrical technologists. The graduates of this programme shall thus in the first instance be equipped with the skills to understand and accurately come up with

engineering designs. Besides, considerable time that has been allocated to laboratory work, the candidate also takes 36 weeks of practical attachment, of which 24 are taken on campus while 12 are taken in industry. In total 66.2% of the contact time is dedicated to practical work leaving 33.8% for theoretical study.

Career Prospects include;

- All power generation, transmission, distribution companies
- Any industry in any sector may be textile, steel, cement, fertilizer, petrochemical, shipping, traction, automobile etc.
- Service sector companies like IT companies, banking, telecommunication etc.
- Consulting companies

1.10 Goals of the Program

The Bachelor of Engineering in Electrical and Electronic Engineering program aims to offer:

i. Technical Knowledge and Skills: Deepening of the knowledge and design skills in Electrical and Electronic Engineering through advanced training
ii. Academic qualifications: impart academic qualifications and skills that are nationally, regionally and globally recognized as per the codes of various engineering bodies and institutions.
iii. Innovative Skills: promote innovation in design, research and implementation of products and services in this particular field hence, provide home-grown solutions to Kenya's problems and the world as a whole.

1.11 Expected Learning Outcomes

The objective in this programme is to offer education and training in electrical and electronic engineering and to equip the candidate with the skills that will normally allow for eventual practice as an engineer. At the end of the program, the graduates are expected to have:

i. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

ii. An ability to function on multidisciplinary teams while understanding the need for professional and ethical responsibility.

iii. An ability to communicate effectively and recognize of the need to engage in life−long learning habits.

iv. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice and understand the impact of engineering solutions in a global, economic, environmental, and societal context.

1.12 Mode of Delivery

The mode of deliveryshall be face to face learning,(full time and part-time (evening)).

1.13 Academic Regulations for the Program

Admission Requirements

a. Common regulations governing the Bachelor of Engineering intake in all Faculties of The Softcore University of Kenya, and those in the School of Electrical and Electronic Engineering shall apply;

b. Candidates shall be eligible for admission into the Bachelor of Engineering in Electrical and Electronic Engineering degree in the School of Electrical and Electronic Engineering in the following categories:

KCSE Candidates

The basic admission requirement shall be the minimum entry requirements set for entry into the public universities, which is at least an average grade of C+ in the Kenya Certificate of Secondary Education (KCSE).

In addition, candidates are expected to have obtained at least a grade C+ in each of the cluster subjects in following cluster of subjects in KCSE examinations:

Cluster Subjects

1. Mathematics
2. Physics

3. Chemistry

4. Biology/any Group III/any Group IV/any Group V.

KCSE Subject Grouping

Group I: English, Kiswahili.

Group II: Biology, Physics, Chemistry

Group III: History and Government, Geography, Christian Religious Education, Islamic Religious Education, Hindu Religious Education

Group IV: Home Science, Art and Design, Agriculture, Aviation Technology, Computer Studies

Group V: French, German, Arabic, Music, Business Studies

A-Levels or Equivalent

Candidates should have a minimum of two (2) principal passes in Mathematics and Physics and a subsidiary level pass in Chemistry with a credit pass in English at O-Level

Exemption from any Courses in the Programme

(a) The point of entry into the programme for candidates with qualifications other than KCSE, A-Levels shall be approved by Senate on the recommendations of the Academic Board of the Faculty of Engineering Science and Technology, and shall be based on the qualifications of the applicant.

(b) Where a candidate wishes to be exempted from any course or courses of study, such candidate shall make a written formal application to the Registrar (Academic) justifying the request and attaching evidence of the credentials which support such request. Such a candidate may be required to sit and pass an exemption examination set and administered by the School and approved under the authority of the Senate on the recommendation of the Faculty Academic Board.

(c) Based on the assessment of the exemption examination, the Academic Board of the Faculty of Engineering Sciences and Technology shall make its recommendation to the University Senate.

The decision of the Senate shall be communicated to the Faculty Academic Board who in turn shall communicate the decision to the candidate.

Course Requirements

a) Students class attendance

A candidate shall be required to attend not less than 75% of the total contact hours of each of the prescribed courses. The fulfilment of the requirement shall be a condition for admission to the examinations for the course at the end of the respective semester of study.

b) Obligation of the Lecturer

A lecturer is mandated by the University to give lectures to students as stipulated by the curriculum of study. The lecturer shall provide all course instructional materials in time; and shall also examine, mark and award scores as is common practice in all institutions of learning, based on the curriculum. The lecturer shall ensure that all work destined for a semester is covered in time and that students are ready to take examinations.

Student Assessment Policy/Criteria

1) Course Units

a) Courses shall be evaluated in terms of course units. A course unit shall be defined as comprising of 48 contact hours made up as four (4) hours of lecture/tutorial/practical per week for twelve (12) weeks. All other course units shall be taken as a proportion of one unit of 48 contact hours.

b) The complete assessment of a course unit shall consist of Continuous Assessment Tests (CATs), course/laboratory/field assignments and relevant end of semester written/performance examinations where applicable.

c) Continuous assessment tests shall constitute:

   i. 30% while written end-of semester examinations constitute 70% of the total marks in the lecture-based course units;

   ii. 100% of the marks in the practical oriented course units.

2) Course Work

a) Overall continuous assessment marks shall be attained from grades achieved within the semester's term papers (assignments), written assignments, field assignments, and attendance, or any combination of these relevant to each course.

b) Practical exercises and industrial attachment assignments shall be examined as part of the respective year of study. A candidate shall complete all such exercises satisfactorily before graduating.

c) The respective weights in the final course assessment as made up of *coursework* and the *end of semester examination* shall be as specified in the approved curriculum for the respective courses of study. Details of the distribution of marks in this respect for the various courses in this programme are as given in section 8 of these regulations

d) In the total assessment of the lecture-based coursework, the various components shall be weighted as follows:

Laboratory/Course work	–	15%
Continuous assessment tests	–	10%
General assignments	–	5%

3) End of Semester Examinations

a) All courses taken in a given semester shall be examined by ordinary university examinations at the end of that semester unless otherwise stated.

b) A written examination for one course unit, where it applies, shall extend over a minimum of two (2) hours.

c) The pass mark in each course of study shall be forty percent (40%) of the maximum mark possible in the course.

4) Special Examinations

a) A candidate who fails to take prescribed examinations on medical grounds or other justifiable grounds, may, on the recommendation by the School Board of Examiners and the Faculty Academic Board, be allowed by Senate to take special examinations on a date prescribed by the Faculty Academic Board.

b) Examinations taken under this clause shall be treated in the same way as an ordinary university examination and shall be graded in full.

5) Supplementary Examinations

c) A candidate who obtains an aggregate mark of not less than 40%, and has failed in not more than the equivalent of one-third (1/3) of all the course units for the particular year of study taken shall, on the recommendations of the School Board of Examiners and the Faculty Academic Board and approval by the Senate, be allowed to take supplementary examinations in the failed courses within three months from the date the examination results are declared by the School Board of Examiners.

(a) A pass obtained in a supplementary examination shall be entered as 40%, which shall then also be the mark entered in the candidate's official academic record.

(b) There shall be no supplementary in the practical courses.

(c) A candidate who fails in a practical course shall re-take the course when next offered.

6) Re-Take Examinations

(a) A candidate who:

(i) has failed in more than the equivalent of one-third (1/3) but in not more than the equivalent of two-thirds (2/3) of the course units taken and has obtained an aggregate mark of not less than forty percent (40%),

OR

(ii) has an aggregate mark of less than forty percent (40%) and has failed in not more than two-thirds (2/3) of the course units taken,

OR

(iii) has failed a supplementary examination

shall, on the recommendations of the School Board of Examiners and the College Academic Board and approval by the Senate, not be allowed to proceed to the next year of study, or in the case of a final year candidate, not be allowed to graduate, but shall instead be required to *re-take* the failed courses in the next academic year.

(b) A re-take examination shall consist in the candidate taking the full prescribed course of study for the course unit including lectures, coursework, continuous assessment tests, all other assignments, and the examination.

(c) A pass obtained in a re-take examination shall be entered as 40%, which shall then also be the mark entered in the candidate's academic record.

(d) Where a candidate has obtained a pass in a re-take examination, the mark as adopted at 40% shall be used to calculate a new aggregate mark for the candidate; such aggregate mark shall then be the one to be officially adopted.

7) Discontinuation from Course of Study

A candidate who:

(a) has failed to take prescribed examinations without good cause,

OR

(b) has failed in more than two-thirds (2/3) of the course units taken in the respective year of study,

OR

(c) has failed in any course after four attempts,

OR

(d) has exhausted the maximum period allowed for registration on the course or part thereof without passing the prescribed examinations, shall, on the recommendation of the School Board of Examiners and the approval of Senate, be discontinued from the course of study.

i) Grading System

a) The aggregate mark (X) obtained for any given course shall be graded as follows:

$X \geq 70\%$	-	A
$60\% \leq X < 70\%$	-	B
$50\% \leq X < 60\%$	-	C
$40\% \leq X < 49\%$	-	D
$X < 40\%$	-	FAIL

b) Except as may be hereinafter provided, in order to be allowed to proceed to the next year of study, a candidate shall have passed in each of the core courses taken in the current year of study.

ii) Compensation Marks

(a) In the final year of study, a mark between 38% and 39% inclusive may be considered qualified for the rule of compensation, provided that the candidate has an aggregate mark of at least 50%.

(b) Compensation may be allowed in a maximum of equivalent of two course units only and shall be applied by taking two marks in a passed subject with a mark above 50% to make up for every failed mark, provided that the grade in accordance with 4.5 (c) of the subject from which the marks have been removed shall not be degraded.

(c) After compensation, the candidate's new aggregate mark shall be calculated on the basis of the individual course marks given after compensation and a candidate's degree shall be graded according to the newly calculated aggregate.

iii) Examination Regulations

a) Examination and Research Malpractices

The following academic malpractices are considered serious and any student found guilty of committing any of them shall be liable to discontinuation or expulsion from the University:

i) Copying or reading from another candidate's script or from any other unauthorized source.

ii) Bringing into the Examination Room any unauthorized materials relevant to the examination, e.g. books, notes, electronic devices with pre-set formulae, mobile phones, pre-written answers, etc.

iii) Abetting, aiding or covering up an examination malpractice.

iv) Seeking or obtaining a deferment of examination on false pretence.

v) Plagiarism

vi) Giving false or forged research data and/ or results and purporting them to be true.

vii) Any deviation from the research/project procedures as prescribed in the approved research proposal without consent of the designated supervisors.

viii) Any other misconduct relating to Research and Examinations.

b) Disciplinary Procedures and Penalties

i) Any examination malpractices shall be reported to the administrators where the course is taught. The report should include statements by the student involved, invigilators and examiners.

ii) On receiving the report, the Executive Dean of the faculty shall convene within two weeks after the report, a faculty disciplinary committee to deliberate on the case.

iii) A sub- committee shall be set up to conduct its procedures in accordance with protocols stipulated by the faculty students' disciplinary committee.

iv) The recommendations of the sub-committee shall be reported to the Faculty Board of Examiners and the Senate as soon as possible, but before the Senate deliberates on the relevant examination results.

v) After Senate deliberation, the recommendation shall be forwarded to the Vice Chancellor for consideration.

vi) Discontinued or suspended students may appeal to the Senate through its chairman within a period of thirty days from the day of discontinuation/suspension. An appeal not submitted within the period shall not be considered.

vii) The University may rescind any degree, diploma or certificate awarded to any person who, while registered in a particular program, committed an academic offence which, if it had been detected before graduation, would have resulted in expulsion. Notification of a rescinded degree, diploma or certificate shall be communicated to all relevant parties.

iv) Moderation of Examinations

The lecturers will deliberate on the following to moderate the examinations;

i) Coverage of course content in the relevant semester

ii) Adherence to Blooms taxonomy- Knowledge, Comprehension, Application, Analysis and Evaluation.

iii) Validity of the questions: Do they measure? What are they supposed to measure? How broad is the domain to be tested? How complete is the coverage?

iv) Utility - The purpose of the assessment and what to be assessed. - The duration of the examination - The group to be assessed

v) Credibility - Are the scores to be reported in relation to those of other examinations on fixed standard? - Are the results believable?

vi) Fairness - This involves provisions made for students with limited proficiency e.g. language. - Are the tests items gender or culturally biased?

vii) Reliability - consistency between test items, between earlier and later measures, between skills and qualities

Formatting question items:

i) Objective questions – multiple choices, matching, etc.

ii) Subjective questions – short answer, fill-in

iii) Item analysis – difficulty verses easy, discrimination

iv) Alternative assessment –attachment

Internal examiner:

i. Is the unit lecturer, who shall award CAT marks and examination marks following the laid down criteria

ii. Shall hand in marks for moderation by the department

iii. The internal examiner may be asked by the department to review the marks upwards or downwards depending on the circumstances that warrant such a review.

External examiner:

i. Shall receive all the departmental scripts, and their marking schemes

ii. Shall go through the scripts to ascertain the validity of the scores

iii. May review the marks upwards or downwards if necessary

iv. Write a report about the examination to the department to assist in examination marking and moderation in future

v. Reviewed marks by the external examiner shall be taken as final marks in a particular course unit.

v. Graduation Requirements

A candidate shall be awarded a Bachelor's degree in Electrical and Electronic Engineering of the School/Faculty, if:

i) He/she has been registered for the Bachelor of Engineering in Electrical and Electronic Engineering as a student in The Softcore University of Kenya for a period of at least 36 months (6 semesters).

ii) He/she has performed such other work and complied with such other conditions as may be stipulated, or after satisfying the requirements for the award of the Bachelor of Science in Electrical and Electronics Engineering, in the School/Faculty concerned after being admitted as a student.

iii) Senate may extend the period of study only on special circumstances as Senate may from time to time determine.

2.7.5 Award, Designation and Classification of the Degree

a) Designation of the Bachelor degree to be awarded under these regulations shall be the **Bachelor of Engineering in Electrical and Electronic Engineering** and shall be abbreviated as **BEng. Electrical and Electronic Engineering**.

b) **The Final Aggregate Mark**

The final award for the degree shall be based on assessment of the performance of the candidate in the **final 3 years** of study. The total aggregate mark shall be calculated by adding up all the marks scored by the candidate in the individual courses in the final 3 years of study as weighted in accordance with the respective subject units. The final mark shall be represented as a percentage of the total mark and shall be adopted as rounded to the nearest integer.

c) Classification of the Bachelor of Engineering Degree

A candidate who qualifies for the award of the Bachelor of Engineering in Electrical and Electronics Engineering Degree shall be placed in one of the classes to be described as

i. First Class Honours,

ii. Second Class Honours (Upper Division),

iii. Second Class (Lower Division) and Pass.

The classification of the final award shall be based on aggregate score (X) obtained as follows

i. First Class Honours - X≥ 70%

ii. Second Class Honours (Upper Division) - 60% ≤ X <70%

iii. Second Class (Lower Division) - 50% ≤ X <60%

iv. Pass - 40% ≤ X <50%

- **No candidate who has at ANY stage in the programme failed in an ordinary university examination shall qualify for the award of the First Class Honours Degree**.
- **No Candidate who has at any stage in the programme been convicted of an Exam Malpractice shall qualify for the award of an Honours Degree.**

2.7.6 Description of project

a) Institutional definition of project

During the 5th year of study, every student shall undertake a final year project. The student is expected to complete the design, assembly and testing of the project and submit the design phase report and give an oral presentation and a demonstration on the functioning of the project to a panel of examiners. The number of students undertaking a particular project shall be limited to a maximum of two students. The project seminar presentation is expected to cover any or all of the following topics: Electronics, Communication, Electronic instrumentation, power systems.

b) Rationale of the project in the programme

(i) appreciate the applications of the theory learnt in class in addressing real world problems
(ii) develop the ability to identify and dene real world engineering problems
(iii) develop the ability to design an engineering system, component or process that meets a desired need

(iv) develop the ability to design, implement and test the product, using appropriate tools and techniques
(v) develop the ability to analyse, demonstrate and orally present experimental results/researchfindings

c) Facets of the project

(i) develop an electrical/electronic engineering project, manage and execute it
(ii) use relevant tools and demonstrate practical skills in implementing the project objectives
(iii) test and commission the designed product
(iv) produce a project report
(v) present the project work to the departmental examination board

d) Regulations of the project

(i) Project proposal and examination. Examinable components include proposal write up and oral presentation
(ii) Project implementation in consultation with the supervisor
(iii) Project final examination. The examinable components include dissertation write up, oral presentation and project demonstration

2.8 Course evaluation

Thecourse shall be evaluated through the following mechanism:

a) Student surveys which shall be conducted every semester
b) External examiners report
c) Periodic departmental workshops to evaluate the courses offered after every five years.

2.9Management and Administration of the Program

i. The program is housed in the Department of Electrical and Power Engineering under the School of Electrical and Electronics Engineering in the Faculty of Engineering Sciences and Technology.

ii. The chairperson of the Department and staff shall take charge of administering of the program.

iii. Quality assurance mechanisms will be put in place through, coverage of course content, preparation of course outlines, coursework, end of semester examinations, external examination benchmarking and lecturer appraisal.

2.10Courses/Units offered for the Program

The programme is covered in 5376 hours and 98.5 course units. Considering then that a nominal hour for a practical semester is counted as only half a contact hour, the total contact hours on the programme comes to 3,840 of which 1,268 are dedicated to lectures while 2,572 shall be taken up by practical and tutorial work. Thus on the programme, 33.0% of the contact time shall be allocated to lectures while 67.0% shall be taken up by practical and tutorial work.

Students will be admitted into the four options, namely *power systems engineering*, *telecommunication systems engineering*, *instrumentation and control engineering*, e*lectronic and computer engineering. The option taken shall be determined at entry into the programme* select a particular subject area of specialisation and then take all the respective electives in the cluster.

The units of study in the first, second, third, and fourth years of study are all common to all options, while in the fifth year of study, a student takes eight common units with eight units being option dependent. The common courses constitute four units of project. The option dependent units are grouped into the four subject areas, namely, *power systems engineering*, *telecommunication systems engineering*, *instrumentation and control engineering*, and *electronic and computer engineering*. Each of these option areas has eight units, with four units to be taken in the second semester while the other four are to be taken in the third semester.

In addition, the student is required to cover two non-credit units on 'Health and Emerging Diseases' and 'Drug and Substance Abuse' each of which is to be covered in 24 hours. These non-credit courses shall have to be taken and passed in Part I of the course of study. The two courses shall be assessed on the basis of 'pass' and 'fail' and a student shall not be allowed to proceed to the second part of the course without having obtained a 'pass' in each of the courses. The marks obtained in each of the courses shall however not be used in determining the final grade of the student in any of the examinations.

The distribution of the contact hours by subject areas is as indicated.

Subject Area	Nominal Hours	Contact Hours	Units	% Nominal Hrs / Units	% Contact Hrs / Units
Engineering Science and Design	2604	2604	54.25	48.4%	55.1%
Engineering Projects	1056	624	13	19.6%	13.2%
Mathematics	480	480	10	8.9%	10.2%
Basic Sciences	432	432	9	8.0%	9.1%
Industrial Attachment	432	216	4.5	8.0%	4.6%
Social Sciences	228	228	4.75	4.2%	4.8%
Professional Engineering Studies	144	144	3	2.7%	3.0%
Total	**5376**	**4728**	**98.5**	**100%**	**100%**

The various courses of study on the programme shall be assessed on the basis of coursework and written examination. For the entire programme coursework shall account for 44.8% while written examinations shall be responsible for 55.2% of the total marks a student may earn.

2.11Course Structure and Duration

(a) The curriculum for the degree programme shall not exceed a period of 10 years of study.

(b) A candidate enrolled for the degree shall satisfactorily complete such curriculum in a period of not more than twice the minimum period specified for the degree programme.

(c) The curriculum shall consist of an approved scheme of study.

(d) The programme of study shall be divided into two parts; Part I and Part II. Part I of the programme shall be comprised of the first and second years study while Part II shall comprise of the third, fourth, and fifth years of study.

(e) A candidate shall be required to complete Part I of the programme of study in not more than four years of study and Part II of the programme in not more than six years of study.

(f) Each academic year shall normally be divided into two semesters of fifteen (15) weeks each. The fifteen weeks shall be divided into twelve (12) weeks of teaching and three (3) weeks of examination. However, the third, fourth, and fifth years of study shall be made up of three semesters in which the first semester of study shall be a practical semester of twelve (12) weeks, during which candidates shall take a period of industrial attachment conducted

either in industry or internally in the college as provided for in the curriculum. The second and third semesters in the third, fourth, and fifth years of study shall be normal academic semesters of fifteen weeks' duration.

(g) A candidate for the degree shall satisfactorily complete such coursework, continuous assessment tests, and practical assignments as may be prescribed for in the scheme of study. Satisfactory completion of such requirements shall be a condition for admission to the examinations at the end of the respective semester of study.

(h) A candidate for the degree shall be required to attend not less than 75% of the total contact hours of each of the prescribed courses and the fulfilment of the requirement shall be a condition for admission to the examinations for the course at the end of the respective semester of study.

(i) All courses of study in the first, second, third, fourth and fifth years of study shall be compulsory, except for cases where the candidate will have been so exempted in accordance with paragraph 1.4.2.

2.11.1 Summary of the Programme of Study

		Code	Unit Title	pre-requisites	Hrs	Units
Year I	**Semester I**	EEEQ101	Mathematics 1A	**C+ in Mathematics in KCSE**	96	2
		EEEQ102	Physics A	C+ in Mathematics in KCSE	60	1.25
		EEEQ103	Chemistry A	C+ in Physics KCSE	48	1
		EEEQ104	Biological Science	C+ in Chemistry in KCSE	48	1
		EEEQ105	Computer Science A	C+ in KCSE	60	1.25
		EEEQ106	Introduction to Engineering	C+ in KCSE	36	0.75
		EEEQ107	Engineering Graphics A	C+ in KCSE	60	1.25
		EEEQ108	Communication Skills	C+ in KCSE	24	0.5
					432	**9**
	Semester II	EEEQ110	Mathematics IB	C+ in Mathematics in KCSE	96	2
		EEEQ111	Physics B	C+ in Physics KCSE	60	1.25
		EEEQ112	Chemistry B	C+ in Chemistry in KCSE	48	1
		EEEQ113	Earth and Environmental Science	C+ in KCSE	48	1
		EEEQ114	Computer Science B	C+ in KCSE	60	1.25
		EEEQ115	Engineering Graphics B	C+ in KCSE	60	1.25
		UCC1102	Critical and Creative Thinking	C+ in KCSE	24	0.5
		EEEQ117	Elements of Economics	C+ in KCSE	24	0.5
					432	**9**
					864	**18**

Year II	**Semester I**	EEEQ201	Mathematics IIA	Mathematics IA,B	48	1
		EEEQ202	Fluid Mechanics	Physics and Mathematics	60	1.25
		EEEQ203	Solid and Structural Mechanics	Physics and Mathematics	60	1.25
		EEEQ204	Thermodynamics	Physics and Mathematics	60	1.25
		EEEQ205	Entrepreneurship and Business Development	C+ in KCSE	48	1.0
		EEEQ206	Energy Resources	Physics and Mathematics	48	1.0
		EEEQ207	Electric Circuit TheoryIA	Physics and Mathematics	60	1.25
		EEEQ208	Physical Electronics A	Physics and Mathematics	60	1.25
					444	**9.25**
	Semester II	EEEQ209	Mathematics IIB	Mathematics IIA	48	1
		EEEQ210	Introduction to Electrical Engineering	Physics and Mathematics	60	1.25
		EEEQ211	Mechanics of Machines	Physics and Mathematics	60	1.25
		EEEQ212	Material Science	Electric Circuit Theory IA	60	1.25
		EEEQ213	Electric Circuit Theory IB	Physical Electronics A	60	1.25
		EEEQ214	Physical Electronics B	Physics and Mathematics	60	1.25
		EEEQ215	Instrumentation and Measurement	Physics and Mathematics	60	1.25
		EEEQ216	Electrical Energy Systems	Energy Resources	60	1.25
					408	**8.5**
					816	**17**
Year III	**Semester I**	EEEQ301	Internal Attachment (Workshop Practice)	All year I and II units.	432	4.5
					432	**4.5**
	Semester II	EEEQ302	Linear Algebra	Mathematics IIB	48	1
		EEEQ303	Geometry	Mathematics IIB	48	1
		EEEQ304	Electrical Circuit Theory IIA	Electric Circuit Theory IB	60	1.25
		EEEQ305	Analogue Electronics A	Physical Electronics B	60	1.25
		EEEQ306	Programming and Simulation	Computer Science B	60	1.25
		EEEQ307	Electromagnetic Fields A	Physics and Mathematics	60	1.25
		EEEQ308	DC Machines and Transformers	Electrical Circuit Theory	60	1.25
		EEEQ309	Telecommunications and Acoustics A	Physical Electronics	60	1.25
					432	**9**
	Semester III	EEEQ310	Probability and Statistics	Mathematics IIB	48	1
		EEEQ311	Numerical Methods	Mathematics IIB	48	1
		EEEQ312	Electric Circuit Theory IIB	Electrical Circuit Theory IIA	60	1.25
		EEEQ313	Analogue Electronics B	Analogue Electronics A	60	1.25
		EEEQ314	Electromagnetic Fields B	Physics and Mathematics	60	1.25

		EEEQ315	Electronic Circuit Design and Fabrication	Analogue Electronics A	60	1.25
		EEEQ316	Digital Electronics	Analogue Electronics A	60	1.25
		EEEQ317	Telecommunications and Acoustics B	Physical Electronics	60	1.25
					432	**9**
					1224	**21**
Year IV	**Semester I**	EEEQ401	Internal Attachment (Project Design and Fabrication)	All units year I to III	432	4.5
					432	**4.5**
	Semester II	EEEQ402	Linear Integrated Circuits	Electronic Circuit Design and Fabrication	60	1.25
		EEEQ403	Power Electronics	Analogue Electronics B	60	1.25
		EEEQ404	Transmission Lines and Waveguides	Electromagnetic	60	1.25
		EEEQ405	Digital Signal Processing	Digital Electronics	60	1.25
		EEEQ406	Control Systems Engineering A	Electric Circuit Theory IIB	60	1.25
		EEEQ407	Microprocessor Systems A	Digital Electronics	60	1.25
		EEEQ408	Law for Engineers	KSCE C+	60	1.25
		EEEQ409	Induction Machines	DC Machines and Transformers	60	1.25
					420	**8.75**
	Semester III	EEEQ410	Embedded Systems	Digital Electronics	60	1.25
		EEEQ411	Sensors and Micro-Electro-Mechanical Systems	Control Systems Engineering A	60	1.25
		EEEQ412	Internet Databases and Programming	Programming and Simulation	60	1.25
		EEEQ413	Synchronous and Special Machines	DC Machines and Transformers	60	1.25
		EEEQ414	Control Systems Engineering B	Control Systems Engineering A	60	1.25
		EEEQ415	Robotics and Cybernetics	Control Systems Engineering A	60	1.25
		EEEQ416	Microprocessor Systems B	Microprocessor Systems A	60	1.25
		EEEQ417	Engineering Management	KSCE C+	48	1.0
					420	**8.75**
					1272	**22**
Year V	**Semester I**	EEEQ501	Industrial Attachment	All units year I to IV	432	4.5
					432	**4.5**
	Semester	**Core**				

II

EEEQ502	Digital Communication	All units year I to IV	60	1.25
EEEQ503	State Space Design and Digital Control	All units year I to IV	48	1
EEEQ504	Wireless LANS	All units year I to IV	48	1
EEEQ505	Engineering Project A	All units year I to IV	96	2
			192	**4**

Electives

Power Systems Engineering

EEEQ506	Power Systems Analysis	DC Machines and Transformers	48	1
EEEQ507	Transmission and Distribution of Electrical Energy	DC Machines and Transformers	48	1
EEEQ508	Protection and Switchgear	DC Machines and Transformers	48	1
			192	**4**

Telecommunication Systems Engineering

EEEQ509	Antenna Theory and Design	Electromagnetics B	48	1
EEEQ510	Wireless Communication	Electromagnetics B	48	1
EEEQ511	Multimedia Communication	Programming and Simulation	48	1
			192	**4**

Instrumentation and Control Engineering

EEEQ512	Artificial Neural Networks	Control Systems Engineering B, Robotics and Cybernetics	48	1
EEEQ513	Industrial Programmable Logic Controllers	Control Systems Engineering B, Robotics and Cybernetics	48	1
EEEQ514	Instrumentation and Biomedical Systems	Control Systems Engineering B, Robotics and Cybernetics	48	1
			192	**4**

Electronic and computer engineering

EEEQ515	Distributed Computing and Networks	Digital communication	48	1
EEEQ516	Industrial Programmable Logic Controllers	Embedded Systems	48	1
EEEQ517	Multimedia Communications	Digital signal processing	48	1
			192	**4**

Semester III **Core**

EEEQ518	Professional Engineering Practice	All units year I to IV	48	1

EEEQ519	Microelectronics and VLSI Design	All units year I to IV	48	1
EEEQ520	Engineering Project B	All units year I to IV	96	2
			192	**4**

Electives

Power Systems Engineering

EEEQ521	Economics of Power Supplies and Load Flow Studies	Transmission and Distribution of Electrical Energy	48	1
EEEEQ522	Electrical Machine Drives	Transmission and Distribution of Electrical Energy, Synchronous and Special Machines, Induction Machines	48	1
EEEQ523	Electrical Machines Design	Transmission and Distribution of Electrical Energy, Synchronous and Special Machines, Induction Machines	48	1
EEEQ524	Energy Conservation and Management	Transmission and Distribution of Electrical Energy	48	1
			192	**4**

Telecommunication Systems Engineering

EEEQ525	MicrowaveSolidState Devices and Circuits	Electromagnetics B	48	1
EEEQ526	Integrated Optics and Photonic Systems	All units year I to IV	48	1
EEEQ527	Satellite and Mobile Communication Systems	Electromagnetic	48	1
EEEQ528	Spread Spectrum and CDMA	Digital Communication	48	1
			192	**4**

Instrumentation and Control Engineering

EEEQ529	Distributed Control Systems	Control Systems Engineering B, Robotics and Cybernetics	48	1
EEEQ530	Pneumatics and Hydraulic Systems	Control Systems Engineering B, Robotics and Cybernetics	48	1
EEEQ531	Environmental Instrumentation	All units year I to IV	48	1
EEEQ532	Digital Control Engineering	Control Systems Engineering B, Robotics and Cybernetics	48	1
			192	**4**

Electronic and computer engineering

EEEQ533	Digital Transmission	Embedded Systems	48	1
EEEQ534	Distributed Control Systems	Embedded Systems	48	1
EEEQ535	Mobile Computing	Embedded Systems	48	1
EEEQ536	Artificial Intelligence and Expert Systems	Embedded Systems	48	1

			192	**4**
			1200	**20.5**
			5376	**98.5**

In addition to the above courses, the student shall be required to take the following as non-credit courses. The candidate shall be required to have passed in the courses in order to be admitted into Part II of the programme of study. Students are encouraged to take the modules in the first year of study. The courses shall be appropriately certificated.

Code	Course Title	Hours	Unit
UCC 001	Health and Emerging Diseases	24	0.5
UCC 002	Drug and Substance Abuse	24	0.5
		48	**1**

3. Courses Descriptions

(a) Year I

Semester I

EEEQ101 Mathematics IA **96 hrs, 2.0 units**

Part1 (General mathematical concepts) ***48 hrs, 1 unit***

Prerequisites

None

Purpose

The aim of this course is to enable the student to;

1. learn laws of algebra
2. understand mathematical manipulation involving power series and complex numbers
3. gain knowledge about complex numbers and their application to trigonometry

Learning Outcomes

At the end of this course, the student should be able to;

1. use linear laws to interpret experimental data
2. solve mathematical problems involving finite and infinite power series
3. perform mathematical operations involving complex numbers and application to trigonometric identities

Course Description

Basic concepts: the real number system; function, domain, and range; mathematical induction. Trigonometric functions: definitions, trigonometric formulae. Basic concepts in coordinate geometry: rectangular Cartesian coordinates; the straight line, the circle, the ellipse, the hyperbola, the parabola, asymptotes; polar coordinates. Functions: combination of functions;

symmetry in functions; inverse functions; continuity and discontinuity of functions. Complex numbers: real and imaginary forms; geometry of complex numbers; modulus-argument form of a complex number; roots of complex numbers. Limits.

Teaching Methodology

3 hour lectures and 1 hour tutorial per week

Mode of course assessment: Continuous assessment and written University examinations shall contribute 30% and 70%, respectively of the total marks.

Instructional Materials/Equipment

1. Presentation software
2. LCD projector

Course Text Books

1. Ron Larson, (2017), *Algebra and Trigonometry,* Cengage Learning.
2. Michael Sullivan,(2015) Algebra and Trigonometry, Pearson.

Course journals

1. Journal of Algebra and Its Applications (JAA)
2. International Journal of Algebra

References Text Books

1. Margaret L. Lial, John Hornsby, David I. Schneider, Callie Daniels (2016), *College Algebra and Trigonometry,*Pearson.
2. Harold R Jacobs, (2016), Elementary Algebra, Master Books.
3. Wallace C. Boyden (2014), *A First Book in Algebra,*CreateSpace Independent Publishing Platform**.**

References journals

1. The Journal of Algebraic Geometry.
2. Journal of Algebraic Combinations

3. Journal of Algebra, Elsevier

Part 2 (Analysis -Calculus) ***48 hrs, 1 unit***

Prerequisites

None

Purpose

The aim of this course is to enable the student to;

1. understand the laws of calculus
2. understand the various methods of differentiation and integration
3. apply calculus to engineering problems involving kinematics

Learning Outcomes

At the end of this course, the student should be able to;

1. differentiate given mathematical equations using first principles
2. extend the laws of differentiation to trigonometric, logarithmic and exponential functions
3. carry out integration and apply the knowledge to areas of surfaces and volumes

Course Description

Ordinary differentiation: the derivative; Leibniz's formula; the differential; implicit differentiation; inverse trigonometric functions; parametric differentiation; properties of differentiability. Exponential, hyperbolic, and logarithmic functions. Functions of two variables: definition; limits and continuity. Partial differentiation: the partial derivative; the total differential; the chain rule; change of variable in partial differentiation. Integration: integration as inverse of differentiation; techniques for integration; the definite integral; numerical integration; geometric application of the definite integral.

Teaching Methodology

3 hour lectures and 1 hour tutorial per week

Mode of course assessment: Continuous assessment and written University examinations shall contribute 30% and 70%, respectively of the total marks.

Instructional Materials/Equipment

1. Presentation software
2. LCD projector

Course Text Books

1. Philip Gillett, (2014), *Calculus and Analytic Geometry*, BVT Publishing
2. Larry J. Goldstein, David C. Lay, David I. Schneider, Nakhle H. Asmar, (2017), *Calculus and its application*, Pearson Education.
3. James Stewart, (2015), Calculus, Brooks Cole**.**

Course Journals

Advances in Calculus of Variations

Reference Textbooks

1. Geoffrey C. Berresford , Andrew M. Rockett , (2015) Applied CalculusBrooks Cole.
2. Bird J. O, May A. J. C. (1985), *Calculus for technicians*, Pearson Professional Education, 2nd Ed.
3. Sherlock A. J. (1982), *Calculus pure and applied*, Hodder Anold, 1st Ed.

Reference journals

Advances in Calculus of Variations

EEEQ102 Physics A 60 hrs, 1.25 units

Prerequisites

None

Purpose

The aim of this course is to enable the student to;

1. understand the physical concepts in basic mechanics and thermal physics

2. gain foundation of engineering applications
3. know the basic principles of optics and quantum concepts
4. understand the basic principles of operation of optical devices

Learning Outcomes

At the end of this course, the student should be able to;

1. solve simple problems of kinetics, kinematics and dynamics of particles and rigid bodies
2. derive and apply the various scientific formulae for gravitation, elasticity, momentum, circular motion and energy
3. explain expansion of matter and mechanisms of heat transfer
4. describe the principles of optics as applied to mirrors, lenses and propagation

Course Description

Introduction to physics: the definition and scope of physics - measurements, units, vectors and coordinate systems. Mechanics: speed, velocity, and acceleration; motion in one and two dimensions; Newton's laws of motion; work and kinetic energy; potential energy and conservation of energy; linear momentum and conservation of momentum; rotation of a rigid body; rolling motion and angular momentum; static equilibrium of a rigid body; oscillatory motion; gravity – Newtonian; solids and elasticity; fluid mechanics. Mechanical waves: wave motion; sound waves – acoustics, production and propagation of sound; superposition and standing waves. Thermodynamics: thermal properties of matter; heat and thermal energy; the first law of thermodynamics; the kinetic theory of gases; heat engines and the second law of thermodynamics

Teaching Methodology

2 hour lectures and 1 hour tutorial per week, and at least five 3-hour laboratory sessions per semester organized on a rotational basis.

Mode of course assessment: Continuous assessment and written University examinations shall contribute 30% and 70%, respectively of the total marks.

Instructional Materials/Equipment

1. Physics laboratories
2. Computer laboratory

Course Text Books

1. Young H. D. & Freedman R.A (2015), *University Physics with Modern Physics*, Pearson.
2. Ohanian H. C. & Markert J (2007), *Physics for Engineers*, W. W. Norton & Co Ltd

Course journals

1. Journal of Physics A: Mathematical and General
2. Journal of Physics B: Atomic, Molecular and Optical Physics

References Text Books

1. Hugh D. Young , Philip W. Adam, Raymond Joseph Chastain,(2015), *College Physics*, Pearson.
2. Knight R. D. (2016), *Physics for Scientists and Engineers, A strategic approach*, Addison Wesley

References journals

1. Journal of Physics: Condensed Matter
2. Journal of Physics D: Applied Physics
3. Journal of Physics G: Nuclear and Particle Physics

EEEQ103 Chemistry A **48 hrs, 1.0 units**

Prerequisites

None

Purpose

The aim of this course is to enable the student to;

1. appreciate the basic underlying processes and concepts of inorganic chemistry
2. Have in-depth understanding of the under-lying principles and concepts of physical chemistry

Learning Outcomes

At the end of this course, the student should be able to;

1. state the fundamental properties of matter, number of protons, neutrons, and electrons
2. describe the periodic table arrangement of elements and the elements' chemistry characteristics for groups along periods and down periodic table
3. describe the characteristics of and significance of some salts and elements

Course Description

Inorganic chemistry: Solubility, precipitation, ion-exchange nitrification and denitrification, oxidation - reduction reactions, adsorption, characteristics and significance of some salts and elements (ammonia, nitrates, phosphates, sulphates, silicates, chlorine, oxygen, ion, carbon, etc). Physical Chemistry; ions in solution, ionization energy, chemical energetics and bonding, chemical equilibrium kinetics.

Teaching Methodology

2 hour lectures and 1 hour tutorial per week, and at least five 3-hour laboratory sessions per semester organized on a rotational basis.

Mode of course assessment: Continuous assessment and written University examinations shall contribute 30% and 70%, respectively of the total marks.

Instructional Materials/Equipment

1. Chemistry laboratories
2. LCD projector

Course Text Books

1. Lawrence S. Brown, Tom Holme,(2014), *Chemistry for Engineering, Cengage Learning.*
2. Andrew Parsons, Gareth Price,(2017), Chemistry3*: Introducing Inorganic, Organic and Physical Chemistry,*Oxford University Press.

Course Journals

1. International Journal of Chemical and Biomolecular Engineering, World Academy of Science, Engineering and Technology
2. International Journal of Electrochemical Science, Electrochemical Science Group

References Books

1. Zumdahl S. S. & Zumdahl S. A. (2014), *Chemistry*, Houghton Mifflin Company
2. Epstein L. M. & Krieger P. (2015), *Schaum's Outline of College Chemistry*, McGraw Hill 10th Ed.
3. Pignataro B. (2010),*Ideas in Chemistry and Molecular Sciences: Advances in Synthetic Chemistry*, Wiley.
4. Haynes William M., (2016), *CRC Handbook of Chemistry and Physics*, CRC Press.

Reference Journals

1. Journal of Analytical Chemistry Insights, Libertas Academica
2. Open Analytical Chemistry Journal, Bentham open
3. Journal of Automated Methods and Management in Chemistry, Hindawi Publishing Corporation.

EEEQ104 Biological Science 48 hrs, 1.0 units

Purpose

To introduce the fundamentals of biology to engineering students as a critical application discipline for engineering analysis and design.

Objectives of the course

1. Demonstrate knowledge of biological issues
2. Demonstrate ability to combine engineering and biological knowledge in theircareers
3. Explain impacts of environmental hazards on living systems

4. Apply biological knowledge in engineering practice through sustainable use of natural resources
5. Demonstrate an understanding of engineering as it relates to biological systems

Learning Outcomes

At the end of the course the student will:

1. Attain knowledge of contemporary biological issues
2. Understand the impact of engineering solutions in biological and biomedical research
3. Develop ability to combine engineering and biological knowledge in their careers
4. Demonstrate understanding of engineering on biological systems and living things

Course Content

Diversity of Life: Five kingdoms of life. Organization of life forms: cells, tissues, organ and organ systems. Chemicals of life: Organic and inorganic compounds, balanced diet, deficiency diseases. Introduction to human anatomy and physiology: homeostasis, digestive, reproduction, nervous and endocrine systems. Effects of radiation, chemical and electrical waves on living things. Ecology: Ecosystems, Cybernetics of ecosystems, biogeochemical cycles, food chains and webs, effect of man on ecosystem, economic botany. Economic importance of microorganisms. Biomagnification. Pharmacology and Toxicology: types of toxic substances, pollutants (carcinogens), effects of drugs/toxins in the body, routes of drug administration. Entomology: beneficial insects, vectors and diseases, destructive pests of timber/wood/electrical cables and wires.

Teaching methodology

The course work will be taught through Lectures, guided classroom discussions andstudent group presentations. Relevant practical assignments for students, group worksand presentations will also be employed.

Prescribed text books

1. Johnson, A.R. (2010), Biology for engineers, CRC press.
2. Scott Freeman, Kim Quillin, Lizabeth Allison, Michael Black, Emily Taylor, Greg Podgorski, Jeff Carmichael,(2016), Biological Science, Pearson.
3. G. Tyler Miller, Scott Spoolman,(2014) Living in the Environment,Brooks Cole.

Course Journals

International Journal of Biological Sciences

Research Journal of Biological Sciences (2015 Volume 10).

Reference Textbooks

1. Elaine N. Marieb, (2014) Essentials of Human Anatomy and Physiology, Pearson.
2. Campbell, Neil, Jane Reese, Martha Taylor, Eric Simon, and Jean Dickey. Biology: Concepts and Connections:

Reference Journals

Journal of Biological Sciences

PLOS Biology

EEEQ105 Computer Science A **60 hrs, 1,25 units**

Prerequisites

None

Purpose

The aim of this course is to enable the student to;

1. be equipped with the learner with the necessary computer system skills to operate a computer and lay the foundation of computing
2. understand the general overview and the fundamental components of a computer system
3. understand computer system operations and security.

Learning Outcomes

At the end of this course, the student should be able to;

1. explain general overview of computer systems

2. explain interrelationship between system components
3. understand operating systems and to use them to operate, troubleshoot and system security

Course Description

Introduction to computers: Definition, nature and function of computers; Historical background. Hardware devices: CPU; secondary storage; input and output devices. Software: definition; algorithms; operating system; programming languages; application software. Number systems. Data types and structures: number, characters, strings, graphics, sounds and others. Information storage: Records and files, tabulation and other methods of information organization. Information processing: access, summation and sorting. Processing errors: rounding, truncation and cancelling errors. Introduction to Computer networks. Internet: Email, searching and browsing.

Teaching Methodology

2 hour lectures and 1 hour tutorial per week, and at least five 3-hour laboratory sessions per semester organized on a rotational basis.

Mode of course assessment: Continuous assessment and written University examinations shall contribute 30% and 70%, respectively of the total marks.

Instructional Materials/Equipment

1. Presentation software
2. LCD projector
3. Computer laboratory

Course Textbooks

1. Norton P. (2002) *Introduction to computers*, Career Education, 5th Ed.

2. Capron H. L., & Johnson J.A. (2003) *Computers: Tools for Information Age*, Prentice Hall, 8th Ed.

Course Journals

Reference Textbooks

1. Glenn Brookshear, Dennis Brylow, (2014) *Computer Science: An Overview,* Pearson.
2. Manaullah Abid, Mohammad Amjad, (2015) *Fundamentals of Computers,* I K International Publishing House.

Reference Journals

EEEQ106 Introduction to Engineering 36 hrs, 0.75 units

Prerequisites

- Communication skills
- Physics
- Chemistry
- Biology

Purpose

The aim of this unit is to enable the learner to:

1. understand the impact of engineering solutions in a global, economic, environmental, and societal content
2. recognize the need for, and an ability to engage in life-long learning.

Learning outcomes

At the end of this unit learner should be able to:

1. communicate effectively.
2. identify and formulate engineering problems
3. understand of professional and ethical responsibility
4. use the techniques, skills, and modern engineering tools necessary for electrical engineering practice.

Course Description

Definition of engineering: the scope of the engineering profession; the profession of engineering; fields of engineering; functions of engineering; levels of personnel in the engineering team - the scientist, the engineer, the technologist, the technician, the craftsman. The engineer as a professional: responsibilities and obligations of the professional engineer; professional recognition; professional organizations; professional ethics. The engineering approach to problem solving, tools of engineering: calculations and analysis; computers and computer techniques; experimentation and testing; communication. The economic and social element in engineering: engineering economics, engineering management; the social dimension. Industrial visits, public lectures by practicing engineers and case studies.

Teaching Methodology

- Overhead projector
- Lecture room
- Four Lab per semester

Modes of course assessment

Coursework for the unit shall be by continuous assessment and shall be defined as comprising assignments and continuous assessment tests and University examination to contribute 40% and 60% respectively for the total marks.

Instructional materials/Equipment

- Overhead projector
- Lecture room

Course Textbooks

1. Mike W. Martin,(2010) Introduction to Engineering Ethics,McGraw-Hill.
2. Farouk A.M. Rizk, Giao N. Trinh, (2014) High Voltage Engineering, CRC Press.
3. Alexander, C &Sadiku, M. (2016) Fundamental of electric circuits, McGrawhill.
4. Tront, J. G. (2005) Pspice for basic circuit analysis with CD, McGraw-Hill.

5. Maloney, T. J. (2003) Modern Industrial electronics 3rded Englewood cliffs, NJ, Prentice Hall.

EEEQ107 Engineering Graphics A 60 hrs, 1.25 units

Prerequisites

None

Purpose

The aim of this course is to enable the student to;

1. understand basic aspects of engineering drawing practice
2. gain skills of engineering drawing and sketching
3. understand basic electrical and piping drawings

Learning Outcomes

At the end of this course, the student should be able to;

1. select and use appropriate drawing instruments for a particular drawing task and construct loci of points in mechanisms commonly encountered in mechanical engineering
2. make orthographic drawings given pictorial drawings, interpret orthographic drawings and make isometric and oblique drawings/sketches for a given orthographic drawing
3. make free-hand sketches

Course Description

Definition of technical graphics; various aspects of technical graphics; uses of technical graphics. Technical graphics equipment. Types on-dimensional views i.e. isometric, perspectives and oblique. Construction of loci, different types of thread forms, cams and gear teeth profiles. Introduction to graphic techniques and equipment. Computer aided graphics. Importance, significance and scope of engineering graphics, dimensioning, scales, different types of projections, orthographic projections, Projection of Points and lines in different quadrants, traces, inclinations, and true lengths of the lines, projections on auxiliary planes, shortest distance, intersecting and non-intersecting lines. Planes other than reference planes:

Perpendicular and oblique planes, their traces, inclinations etc. projections of points and lines lying in the planes, conversion of oblique plane into auxiliary plane and solution of related problems. Projections of plane figures: different cases of plane figures (of different shapes) making different angles with one or both reference planes and lines lying in the plane figures making different given angles (with one or both reference planes). Obtaining true shape of the plane figure by projection. Projection of solids: Simple cases when solid is placed in different positions, axis, faces and lines lying in the faces of the solid making given angles. Development of simple objects with or without sectioning. Machine drawing: basic concepts: IS drawing conventions, line symbols, Kinds of line, drawing sheet layout, rules of printing, preferred scales.

Teaching Methodology

2 hour lectures and 4 hours of practical work per week.

Mode of course assessment: Continuous assessment and written University examinations shall each contribute 50% of the total marks.

Instructional Materials/Equipment

1. Drawing office
2. Drawing instruments
3. Computer laboratory

Course Text Books

1. Morling K. (2012), *Geometric and Engineering Drawing*, Butterworth-Heinmann, 2nd Ed.
2. Eide A. R., Jenism R. D & Mashaw L. H, (2010), *Engineering graphics fundamentals*, Mc Graw_Hill Inc., 2nd Ed.

Course Journals

1. Journal of Engineering Design, Taylor & Francis
2. Journal of Engineering, Design and Technology

Reference Books

1. Giesecke F. E., Hill I. L. Norak J. E. & Mitchell A. (2016), *Technical Drawing with Engineering Graphics*, Peachpit Press.
2. Thomas E. F, Jay D.H., Byron U. & Carl L. S., (1997), Mechanical Drawing CAD Communications, Mc Graw-Hill, 11th Ed.
3. David A. Madsen, David P. Madsen (2016), *Engineering Drawing and Design*, Delmar Cengage Learning.

Reference Journals

1. Research on Distinguishing Character Based on AutoCAD Engineering Drawing; Computer Technology and Development.
2. Journal of Computer Aided Materials Design
3. Journal of Mechanical Design

EEEQ108 Communication Skills **24 hrs, 0.5 units**

Prerequisites

None

Purpose

The aim of this course is to enable the student to;

1. gain oral and written communication effectiveness
2. understand information dissemination and information gathering
3. be equipped with information gathering and analysis techniques

Learning Outcomes

At the end of this course, the student should be able to;

1. write using appropriate style a technical report, essays, and summaries
2. prepare visual communication aids
3. be able to source and prepare questionnaires

Course Description

The communication process; approaches to the study of communication; information retrieval and library use; listening skills and lecture comprehension strategies; writing skills; direction words, paragraphs and punctuations; methods of taking notes; writing in examinations; writing of assignments, resumes, and reports, Oral representation and public address; information dissemination techniques; communication technology; visual literacy.

Teaching Methodology

3 hour lectures and 1 hour tutorial per week

Mode of course assessment: Continuous assessment and written University examinations shall contribute 30% and 70%, respectively of the total marks.

Instructional Materials/Equipment

1. Flip charts
2. LCD projector

Course textbooks

1. Davies J. W (2011) *Communication Skills; A Guide for Engineering and Applied Science Students*, Prentice Hall.
2. Hybels, (2014) *Communicating Effectively*, HSSL.

Course journals

1. European Journal of Cancer (1999), *Effective communication skills are the key to good cancer care*, Elsevier Inc
2. Flavell, John H. (1968), *The Development of Role-Taking and Communication Skills in Children*, John Wiley and Sons

Reference textbooks

1. Brumif C.J & Johnson K. (1980) *Communicative Approach to Language Teaching*, Oxford University Press
2. Leech G. Svartrik J. (2003), Communicative Grammar of English, Longman Publishers

Reference journals

1. Pamela A. Rowland-Morin (2010) *Verbal Communication Skills and Patient Satisfaction,* sage publications
2. Ross, John A., *The Influence of Computer Communication Skills on Participation in a Computer Conferencing Course,*
3. Lucie Morin, Gary Latham (2000), *The Effect of Mental Practice and Goal Setting as a Transfer of Training Intervention on Supervisors' Self-efficacy and Communication Skills: An Exploratory Study*, John Wiley & Sons

UCC001Health and Emerging Diseases **24 hrs, 0.5 units**

Prerequisites

None

Purpose

The aim of this course is to enable the student to;

1. Understand health and emerging diseases
2. have an overview of various emerging diseases
3. Have an overview of human anatomy and physiology.

Learning Outcomes

At the end of this course, the student should be able to;

1. To get students to understand public health and hygiene
2. To promote the understanding of Sexuality and reproductive health
3. To promote the understanding of the biology of HIV/AIDS - overview of immune system, natural immunity to HIV/AIDS, the AIDS virus and its life cycle,

Course Description

General introduction: an overview of health, emerging environmental health diseases, public health and hygiene, an overview of human anatomy and physiology. Sexuality and reproductive health: a general overview of, urinary tract infections (STI), sexually transmitted

diseases (STD). Human Immunodeficiency Virus/Acquired Immune-deficiency Syndrome (HIV/AIDS): the biology of HIV/AIDS - overview of immune system, natural immunity to HIV/AIDS, the AIDS virus and its life cycle, disease progression (epidemiology), transmission and diagnosis; treatment and management - nutrition, prevention and control, anti-retroviral drugs and vaccines, patient management, pregnancy and AIDS; social and cultural practices; Voluntary Counselling and Testing (VCT) services; policies on AIDS; the impact of AIDS on the social set-up and the economy; history and comparative information on trends of AIDS. An overview of various emerging diseases: a general coverage including Ebola virus, H5N1 influenza (bird flu), and H1N1 (swine flu).

Teaching Methodology

3 hour lectures and 1 hour tutorial per week

Mode of course assessment: Continuous assessment and written University examinations shall contribute 30% and 70%, respectively of the total marks.

Instructional Materials/Equipment

1. Flip charts
2. LCD projector

Course textbooks

Kathy S. Stolley; John E. (2009), **HIV/AIDS**, GlassGreenwood

Course Journals

Journal of Travel Medicine

Semester II

EEEQ110 Mathematics IB **96 hrs, 2.0 units**

Part1 (Linear algebra and systems of equations) ***48 hrs, 1 unit***

Prerequisites

EEEQ101 Mathematics 1A

Purpose

The aim of this course is to enable the student to;

1. learn laws of algebra
2. understand mathematical manipulation involving power series and complex numbers
3. gain knowledge about complex numbers and their application to trigonometry

Learning Outcomes

At the end of this course, the student should be able to;

1. use linear laws to interpret experimental data
2. solve mathematical problems involving finite and infinite power series
3. perform mathematical operations involving complex numbers and application to trigonometric identities

Course Description

Sequences and series: infinite sequences; infinite numerical series; power series; Taylor and Maclaurin series; Taylor's theorem for functions of two variables; Fourier series. Determinants: definition and evaluation of determinants. Matrices: definition; elementary properties of matrices; special matrices; linear transformation and rotations; matrix partitioning; bilinear and quadratic forms; differentiation of matrices. Solution of systems of linear equations: Gaussian elimination and the Gauss-Seidel methods. The eigenvalue problem.

Teaching Methodology

3 hour lectures and 1 hour tutorial per week.

Mode of course assessment: Continuous assessment and written University examinations shall contribute 30% and 70%, respectively of the total marks.

Instructional Materials/Equipment

1. Presentation software
2. LCD projector

Course Text Books

1. Ron Larson, (2017), Algebra and Trigonometry, Cengage Learning.
2. Michael Sullivan, (2015) Algebra and Trigonometry, Pearson.

Course journals

1. Journal of Algebra and Its Applications (JAA)
2. International Journal of Algebra

References Text Books

1. Margaret L. Lial, John Hornsby, David I. Schneider, Callie Daniels (2016), *College Algebra and Trigonometry,* Pearson.
2. Harold R Jacobs, (2016), Elementary Algebra, Master Books.
3. Wallace C. Boyden (2014), *A First Book in Algebra,* CreateSpace Independent Publishing Platform**.**

References journals

1. The Journal of Algebraic Geometry.
2. Journal of Algebraic Combinations
3. Journal of Algebra, Elsevier

Part2 (Vectors Analysis) ***48 hrs, 1 unit***

Prerequisites

EEEQ101 Mathematics 1A

Purpose

The aim of this course is to enable the student to;

1. understand differential calculus
2. learn partial differentiation including first and second partial derivatives and total derivatives
3. appreciate improper and double integrals.

Learning Outcomes

At the end of this course, the student should be able to;

1. understand the concepts of differential calculus including their application to engineering problems
2. understand the concepts of partial differentiation
3. apply integration techniques in determining arc length, plane and surface area, volume, mass centre and moments of inertia of various bodies.

Course Description

Vector algebra: scalars; vectors - definition, addition, representation, the scalar and vector products, representation of straight line and plane in vector form. Vector analysis: vector functions of one variable; velocity, acceleration, curvature, and torsion; vector fields and streamlines; the gradient field; divergence and curl; line integrals; Green's theorem; independence of path and potential theory; surface integrals; the divergence theorem of Gauss; Stokes's theorem.

Teaching Methodology

3 hour lectures and 1 hour tutorial per week.

Mode of course assessment: Continuous assessment and written University examinations shall contribute 30% and 70%, respectively of the total marks.

Instructional Materials/Equipment

1. Presentation software
2. LCD projector

Course Textbooks

1. Stroud K. A. (2013) *Engineering Mathematics*, Springer, 2nd Ed.

2. Charles Watson David Radcliffe & Keith Alexander Dan (1990), *Geometry and Calculus III*,Brooks Waterloo.
3. Jeffrey A. (2014) *Mathematics for Engineers and Scientists*, Chapman & Hall.

Course Journals

Reference Textbooks

1. Spiegel, M. R. (2009) *Schaum's Outline of Advanced Mathematics for Engineers and Scientists*, McGraw-Hill.
2. Polyanin A. D. & Manzirov A. V. (2006) *Handbook of Mathematics for Engineers and Scientists*, Chapman & Hall/CRC Press.
3. Jerrold E Marsden, Alan Weinstein (1985), *Calculus I, II, III*, Springer-Verlag, 2nd Ed.

Reference Journals

EEEQ111 Physics B 60 hrs, 1.25 units

Prerequisites

Physics A

Purpose

The aim of this course is to enable the student to;

1. understand the physical concepts in basic mechanics and thermal physics
2. gain foundation of engineering applications
3. know the basic principles of optics and quantum concepts
4. understand the basic principles of operation of optical devices

Learning Outcomes

At the end of this course, the student should be able to;

1. solve simple problems of kinetics, kinematics and dynamics of particles and rigid bodies
2. derive and apply the various scientific formulae for gravitation, elasticity, momentum, circular motion and energy
3. explain expansion of matter and mechanisms of heat transfer

4. describe the principles of optics as applied to mirrors, lenses and propagation

Course Description

Electricity and magnetism: electric fields; Gauss's law; electric potential; capacitance and dielectrics; current and resistance; direct electric circuits; magnetic fields; electromagnetic induction and inductance; electromagnetic waves; alternating current; L-C-R AC networks; electronics. Light and optics: the nature of light; the electromagnetic spectrum; the propagation of light; geometric optics; physical optics. Modern physics: relativity – special and general theories of relativity; quantum mechanics; nuclear physics; high energy physics. The universe: the structure of the universe; theories and hypotheses on the origins of the universe; the general structure of the universe; galaxies and quasers; the stars and stellar evolution; the sun. The earth in space: earth and the solar system; the earth's gravity and magnetic fields; earth's motions; the concept of night and day; time and the calendar.

Teaching Methodology

2 hour lectures and 1 hour tutorial per week, and at least five 3-hour laboratory sessions per semester organized on a rotational basis.

Mode of course assessment: Continuous assessment and written University examinations shall contribute 30% and 70%, respectively of the total marks.

Instructional Materials/Equipment

1. Physics laboratories
2. Computer laboratory

Course Text Books

1. Young H. D. & Freedman R.A (2015), *University Physics with Modern Physics*, Pearson.
2. Ohanian H. C. & Markert J (2007), *Physics for Engineers*, W. W. Norton & Co Ltd

Course journals

1. Journal of Physics A: Mathematical and General
2. Journal of Physics B: Atomic, Molecular and Optical Physics

References Text Books

1. Hugh D. Young , Philip W. Adam, Raymond Joseph Chastain, (2015), *College Physics*, Pearson.
2. Knight R. D. (2016), *Physics for Scientists and Engineers, A strategic approach*, Addison Wesley

References journals

1. Journal of Physics: Condensed Matter
2. Journal of Physics D: Applied Physics
3. Journal of Physics G: Nuclear and Particle Physics

EEEQ112 Chemistry B 48 hrs, 1.0 units

Prerequisites

Chemistry A

Purpose

The aim of this course is to enable the student to;

1. appreciate the basic underlying processes and concepts of inorganic chemistry
2. Have in-depth understanding of the under-lying principles and concepts of physical chemistry

Learning Outcomes

At the end of this course, the student should be able to;

1. state the fundamental properties of matter, number of protons, neutrons, and electrons
2. describe the periodic table arrangement of elements and the elements' chemistry characteristics for groups along periods and down periodic table
3. describe the characteristics of and significance of some salts and elements

Course Description

Organic chemistry: significance of saturated and unsaturated hydrocarbons, phenols, alcohols, ketones, aldehydes, organic nitrogen compounds, organic halogen compounds structures and characteristics of carbohydrates, proteins and liquids. Applied chemistry: introduction to polymer sciences, hard and soft water (causes and treatment), electro-chemistry, the nitrogen cycle, fuels, fertilizers, soaps and non-soapy detergents, aerobic and anaerobic digestion.

Teaching Methodology

2 hour lectures and 1 hour tutorial per week, and at least five 3-hour laboratory sessions per semester organized on a rotational basis.

Mode of course assessment: Continuous assessment and written University examinations shall contribute 30% and 70%, respectively of the total marks.

Instructional Materials/Equipment

1. Chemistry laboratories
2. LCD projector

Course Text Books

1. Lawrence S. Brown, Tom Holme, (2014), *Chemistry for Engineering, Cengage Learning.*
2. Andrew Parsons, Gareth Price, (2017), Chemistry3*: Introducing Inorganic, Organic and Physical Chemistry,* Oxford University Press.

Course Journals

1. International Journal of Chemical and Biomolecular Engineering, World Academy of Science, Engineering and Technology
2. International Journal of Electrochemical Science, Electrochemical Science Group

References Books

1. Zumdahl S. S. & Zumdahl S. A. (2014), *Chemistry*, Houghton Mifflin Company

2. Epstein L. M. & Krieger P. (2015), *Schaum's Outline of College Chemistry*, McGraw Hill 10th Ed.
3. Pignataro B. (2010), *Ideas in Chemistry and Molecular Sciences: Advances in Synthetic Chemistry*, Wiley.
4. Haynes William M., (2016), *CRC Handbook of Chemistry and Physics*, CRC Press.

Reference Journals

1. Journal of Analytical Chemistry Insights, Libertas Academica
2. Open Analytical Chemistry Journal, Bentham open
3. Journal of Automated Methods and Management in Chemistry, Hindawi Publishing Corporation

EEEQ113 Earth and Environmental Science 48 hrs,1.0 units

Aims

The aim of the Earth and Environmental Science Syllabus is to provide learning experiences through which students will:

1. acquire knowledge and understanding about fundamental concepts related to planet Earth and its environments, the historical development of these concepts and their application to personal, social, economic, technological and environmental situations
2. progress from the consideration of specific data and knowledge to the understanding of models and concepts and the explanation of generalised Earth and Environmental Science terms; from the collection and organisation of information to problem-solving; and from the use of simple communication skills to those which are more sophisticated
3. develop positive attitudes towards the study of planet Earth and its environments, and towards the opinions held by others, recognising the importance of evidence and critically evaluating differing scientific opinions related to various aspects of Earth and Environmental Science.

Learning Outcomes

1. evaluates how major advances in scientific understanding or technology have changed the direction or nature of scientific thinking
2. analyses the ways in which models, theories and laws in Earth and Environmental Science have been tested and validated
3. assesses the impact of particular advances in Earth and Environmental Science on the development of technologies
4. assesses the impact of applications of Earth and Environmental Science on society and the environment

Course Description

Introduction to geology: lithological constituents of rocks, the geological time-scale; the concept of facies, elements of structural geology. Soil genesis and formation: factors of soil formation, parent material, relief, climate, vegetation, fauna, time and man, and physical properties of soil. Introduction and scope of environment: conservation of natural resources i.e. forest resource, water resource, mineral resource, energy resource, land resource etc, role of individual for resource conservation and sustainable development. Ecosystem and its basic concept: structure and function of an ecosystem, producers, consumers and decomposers, energy flow in the ecosystem, ecological succession, food chains, food webs and ecological pyramids. Biodiversity and its conservation: introduction – definition, genetic, species and ecosystem diversity, national and global scenario. Environmental pollution: definition, causes, effects and control measures. Sustainable development: urban problems related to energy, water conservation, rain water harvesting, watershed management, wasteland reclamation, environmental ethics, climate change, global warming, acid rain, ozone layer depletion, and nuclear accidents.

Teaching Methodology

- Overhead projector
- Lecture room

Modes of course assessment

Coursework for the unit shall be by continuous assessment and shall be defined as comprising assignments and continuous assessment tests and University examination to contribute 30% and 70% respectively for the total marks.

Instructional materials/Equipment

- Overhead projector
- Lecture room

Recommended Books:

1. Botkin, D.B & Keller,(2014) *Environmental Science: Earth as a Living Planet*, John Wiley & Sons.
2. *McKinney, M.L., Schoch, R.M. & Yonavjak, L.* (2013) *Environmental Science: systems and solutions,* Jones & Bartlett Publishers.
3. Wright, R.T. & Nebel, B.J.(2016) *Environmental Science: Toward a Sustainable Future,* Pearson Educational.
4. Miller, G., (2005) *Environmental Science: working with the Earth,*Thomson Learnin.

EEEQ114 Computer Science B 60 hrs, 1.25 units

I

Prerequisites

Computer Science A

Purpose

The aim of this course is to enable the student to;

1. be equipped with the learner with the necessary computer system skills to operate a computer and lay the foundation of computing
2. understand the general overview and the fundamental components of a computer system
3. understand computer system operations and security.

Learning Outcomes

At the end of this course, the student should be able to;

1. explain general overview of computer systems
2. explain interrelationship between system components
3. understand operating systems and to use them to operate, troubleshoot and system security

Course Description

Introduction to computer problem-solving: programs and algorithms, problem-solving aspect, top-down design. Software tools for program development - editors, interpreters, compilers. Fundamental algorithms e.g., exchanging the values of two variables, counting, summation of a set of numbers, factorial computation, base conversion etc. Array techniques: array order reversal, finding the maximum number in a set, finding the k^{th} smallest element, removal of duplicates from an ordered array. Data types and declarations: type integer, real, char, Boolean, enumerated and sub-range. Statements, expressions and assignments. Input and output of data. Basic control structures: compound statements, repetitive statements (while, repeat and for statements). Procedures and functions: The procedure concept, block structure and scope. Variable and value parameters. Information hiding and the layered model in software development. Methods of documentation. Structured data structures: arrays, records and sets. Files: the file concept, text files. Pointers: the pointer concept, programming a stack.

Teaching Methodology

2 hour lectures and 1 hour tutorial per week, and at least five 3-hour laboratory sessions per semester organized on a rotational basis.

Mode of course assessment: Continuous assessment and written University examinations shall contribute 30% and 70%, respectively of the total marks.

Instructional Materials/Equipment

1. Presentation software
2. LCD projector
3. Computer laboratory

Course Textbooks

1. Norton P. (2002) *Introduction to computers*, Career Education, 5th Ed.
2. Capron H. L., & Johnson J.A. (2004) *Computers: Tools for Information Age*, Prentice Hall, 8th Ed.

Course Journals

Reference Textbooks

3. Glenn Brookshear, Dennis Brylow, (2014) *Computer Science: An Overview,* Pearson.
4. Manaullah Abid, Mohammad Amjad, (2015) *Fundamentals of Computers,* I K International Publishing House.

Reference Journals

EEEQ115 Engineering Graphics B 60 hrs, 1.25 units

Prerequisites

Engineering Graphics A

Purpose

The aim of this course is to enable the student to;

1. understand basic aspects of engineering drawing practice
2. gain skills of engineering drawing and sketching
3. understand basic electrical and piping drawings

Learning Outcomes

At the end of this course, the student should be able to;

1. select and use appropriate drawing instruments for a particular drawing task and construct loci of points in mechanisms commonly encountered in mechanical engineering

2. make orthographic drawings given pictorial drawings, interpret orthographic drawings and make isometric and oblique drawings/sketches for a given orthographic drawing
3. make free-hand sketches

Course Description

Projections: Perspective, orthographic, isometric and oblique projections, sketching of orthographic views from pictorial views, precedence of lines. Shape description (internal): Importance of sectioning, principles of sectioning, types of sections, cutting plane representation, section lines, and conventional practices. Size description: Dimensioning, size and location dimensioning, principles and conventions of dimensioning, dimensioning exercises. Screwed fasteners: Introduction, screw thread nomenclature, forms of screw threads, thread series, multi-start threads, right hand and left hand threads, representation of threads, bolted joints, locking arrangements for nuts, foundation bolts. Electrical and electronic engineering graphics. Methods of constructing objects in computer aided design software.

Teaching Methodology

2 hour lectures and 4 hours of practical work per week.

Mode of course assessment: Continuous assessment and written University examinations shall each contribute 50% of the total marks.

Instructional Materials/Equipment

1. Drawing office
2. Drawing instruments
3. Computer laboratory

Course Text Books

1. Morling K. (1974), *Geometric and Engineering Drawing*, Butterworth-Heinmann, 2nd Ed.
2. Eide A. R., Jenism R. D & Mashaw L. H, (1965), *Engineering graphics fundamentals*, Mc Graw_Hill inc, 2nd Ed.

Course Journals

1. Journal of Engineering Design, Taylor & Francis
2. Journal of Engineering, Design and Technology

Reference Books

1. David A. Madsen, David P. Madsen,(2016) Engineering Drawing and Design, Delmar Cengage Learning.
2. Giesecke F. E., Hill I. L. Norak J. E. & Mitchell A. (2016), *Technical Drawing*, Peachpit Press.
3. Thomas E. F, Jay D.H., Byron U. & Carl L. S., (2002), Mechanical Drawing CAD Communications, Mc Graw-Hill, 11th Ed.
4. Cecil H. Jensen, Jay D. Helsel, Dennis Short (2007), *Engineering Drawing And Design*, Mc Graw-Hill

Reference Journals

1. Research on Distinguishing Character Based on AutoCAD Engineering Drawing; Computer Technology and Development.
2. Journal of Computer Aided Materials Design
3. Journal of Mechanical Design

UCCC1102 Critical and Creative Thinking 24 hrs, 0.5 units

Purpose of the Course

This course shall equip students with a variety of specific creative and critical thinking skills necessary for them to have in our rapidly changing, technologically oriented world. These skills learn from this course shall promote intellectual growth and foster academic achievement gains.

Expected Learning Outcomes

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

1. Experience a climate of openness, mutual respect, and support for undertaking critical and creative though
2. Develop the foundational knowledge, values, and skills/abilities needed for thinking critically.
3. Develop the foundational knowledge, values and skills/abilities needed for creative thinking.
4. Integrate critical and creative dispositions and abilities to meet learning needs and real life challenges.
5. Adapt Instructional approaches learnt to promote thinking skill development which include redirection, probing, and reinforcement.
6. Develop values, knowledge, and abilities related to: Metacognition; Foundations of critical thinking; Foundations of creative development; integrated critical and creative abilities.

Course Content

Definition, nature and scope of critical and creative thinking: fundamentals of criticality and creativity – Tools, abilities, attitudes, characteristics and process; reasoning skills and argument analysis; fallacies; skilful decision making, creative problem solving models, brainstorming and block busting techniques; language and thinking; criticality and creativity in education; application of advanced critical and creative thinking skills in life and learning; models of critical and creative thinking.

Mode of Delivery

The course work may be taught through Lectures, guided classroom discussions, projectors, student group presentations and relevant videos.

Text Books

1. Halpern, D. F. (2006). The nature and nurture of critical thinking. In R. Sternberg, R.

2. Roediger, & D. F. Halpern, (2004) Critical Thinking in Psychology, Cambridge University Press.
3. Kuhn, D. (1999). A developmental model of critical thinking. Educational Researcher.
4. Marin, L. M., & Halpern, D. F. (2011). Pedagogy for developing critical thinking in adolescents: Explicit instruction produces greatest gains. Thinking Skills and Creativity, 6, 1-13.

EEEQ117 Elements of Economics 36 hrs, 0.75 units

Prerequisites

None

Purpose

The aim of this course is to enable the student to;

1. understand the different types of business ownership
2. understand the concept of consumption theory and utility analysis
3. comprehend demand and supply, market structure, international trade, employment and economic growth

Learning Outcomes

At the end of this course, the student should be able to;

1. analyze demand and supply concepts
2. do analysis of basic accounting techniques

Course Description

Introduction to economics and the economy: Definition and scope of economics; a broad overview of economics; the economy and how it works. Perfect markets: demand, supply, and price; application of demand and supply; consumption and consumer choice; the economics of the firm; labour markets; capital markets. Imperfect markets; the efficiency of competitive markets. Imperfect markets: the concept of the imperfect market; monopoly, monopolistic competition, and oligopoly; Government policies toward competition. Introduction to

macroeconomics: an overview of macroeconomics; measuring economic output and unemployment; the cost of living and inflation. Full-employment macroeconomics: the full employment model; Government finance at full employment; the open economy at full employment; growth and productivity; money, price, and the financial system. Macroeconomic fluctuations: a review of economic fluctuations; aggregate demand and supply; the Central Bank and interest rates; macroeconomic monetary and fiscal policies.

Teaching Methodology

3 hour lectures and 1 hour tutorial per week

Mode of course assessment: Continuous assessment and written University examinations shall contribute 30% and 70%, respectively of the total marks.

Instructional Materials/Equipment

1. Presentation software
2. LCD projector

Course Text Books

1. Campbell R. McConnell (2014), *Economics: principles, problems, and policies*,McGraw-Hill, 9th Ed.
2. Paul Krugman, Robin Wells (2015), *Economics*, Worth Publishers.

Course Journals

1. International Journal of Production Economics
2. International Journal of Social Economics

Reference Books

1. William Boyes, Michael Melvin (2015), *Economics*, Cengage Learning.
2. Thomas Sowell (2014), *Basic Economics: A Common Sense Guide to the Economy*, Blackstone Audio, Inc.
3. Jordan Koma (2016), *Economics: An Introduction to the Basic Fundamentals of*

Economics, Amazon Digital Services LLC.

Reference Journals

1. International Journal of Transport Economics
2. International Journal of Economic Research
3. International Journal of the Economics of Business
4. International Journal of Finance and Economics

UCC002 Drug and Substance Abuse 24 hrs, 0.5 units

This course provides an overview of the epidemiology of drug abuse, the physiological and socio-economic effects of the supply and the use of drugs. The course also discusses issues related the toxicology of substance dependence. The course also exposes the risk factors related to the use and abuse of substances. It also highlights available avenues for treatment, leading to detoxification for the users. The course also does explain some of the policy issues in place to help combat the vice. The course also focuses on the importance of policy and law enforcement agents in curbing substance dependence.

(b) Year II

Semester I

EEEQ201 Mathematics IIA 48 hrs, 1.0 units

Prerequisites

EEEQ110 Mathematics 1B

Purpose

The aim of this course is to enable the student to;

1. understand first order differential equations and second order differential equations
2. know Laplace methods of solution for ordinary differential equations
3. apply ordinary differential equations in dynamics, circuit and wave motion.

Learning Outcomes

At the end of this course, the student should be able to;

1. obtain solutions for first order differential equations and second order differential equations
2. obtain solutions for ordinary differential equation by Laplace transform methods
3. enable the students to apply the concepts of ordinary differential equations to solving engineering problems such as dynamics and wave motion.

Course Description

Ordinary differential equations: first order differential equations- separable equations, homogeneous equations, exact differential equations, integrating factor; second order differential equations- general methods of solution, constant coefficient homogeneous linear equations, Euler equations, the method of undetermined coefficients, the method of variation of parameters; higher order differential equations. Series solutions- power series solutions, singular points and method Frobenius, second solutions and logarithm terms; numerical

approximation of solutions- Euler's method, one-step methods, multi-step and predictor-corrector methods. Systems of linear differential equations: theory of systems of linear first order differential equations; homogeneous linear systems with constant coefficients; solutions for complex eigenvalues; solutions by diagonalization; exponential matrix solutions; variation of parameters; numerical systems. Nonlinear differential equations: autonomous systems; stability and classification of critical points; almost linear systems; limit cycles.

Teaching Methodology

3 hour lectures and 1 hour tutorial per week.

Mode of course assessment: Continuous assessment and written University examinations shall contribute 30% and 70%, respectively of the total marks.

Instructional Materials/Equipment

3. Presentation software
4. LCD projector

Course Textbooks

1. M. A. Alwash (2017), *Ordinary differential equations*,CreateSpaceIndependent Publishing Platform.
2. Richard K Miller, Anthony N. Michel (2014), *Ordinary Differential Equations*, Academic Press.

Course Journals

Reference Textbooks

1. A. Canada, P. Drabek, A. Fonda (2006), *Handbook of Differential Equations: Ordinary Differential Equations,*North Holland.
2. Albert L. Rabenstein (2014), *An introduction to ordinary differential equations*, Academic Press.

EEEQ202 Fluid Mechanics 60 hrs, 1.25 units

Prerequisites

Course objectives

1. Introduces fluid mechanics and establishes its relevance to Electrical engineering
2. Develops the fundamental principles underlying the subject
3. Demonstrates how these are used for the design of simple hydraulic systems

Course Description

Introduction to fluid mechanics: properties of fluids, dimensions and units. Hydrostatic pressure gauges and manometers. Forces and centres of pressure on plane and non-plane surfaces. Floating bodies, metacentre. Free surface correction and suspended loads. Bernoulli's theorem for incompressible flow with proof. Application of Bemoulli' s theorem and momentum equations. Flow measurements: methods of measurement of velocity and discharge, pitot tubes, orifices, nozzles, venturi meters and notches. Representation of energy changes in a flowing fluid system. Time to empty tanks, laminar and turbulent flow in pipes, Reynolds number, D'arcy formula for pipe friction, simple boundary layer theory. Piped networks: Hardy-Cross procedure; water hammer.

Mode of Delivery

The course is delivered through lectures and tutorials

Mode of Assessment

Course work (assignments and tests) and final examinations and their relative contributions to the final grade are shown as follows:

RequirementPercentage contribution

Course work 40%

Final Examination	60%
Total	100%

Course Textbooks

1. Frank White, (2015), *Fluid Mechanics*,McGraw-Hill Education.
2. Pijush K. Kundu, Ira M. Cohen, David R Dowling (2015), *Fluid Mechanics*, Academic Press.
3. Yunus Cengel, John Cimbala (2017) *Fluid Mechanics: Fundamentals and Applications,*McGraw-Hill Education.

Reference Textbooks

1. Russell C. Hibbeler*, (2014), Fluid Mechanics,* Pearson.
2. David A. Chin, (2016), *Fluid Mechanics for Engineers,*Pearson.
3. William S. Janna, (2015), *Introduction to Fluid Mechanics*, CRC Press.

EEEQ203 Solid and Structural Mechanics 60 hrs, 1.25 units

Prerequisites

Purpose

This course introduces students to the study of the behaviour of structural and machine members under the action of external loads. It covers basic concepts of stress and strain, tensile and torsion stresses and strain.

Course learning Objectives/ Outcomes

1. At the end of the course, the student should be able to:
2. Explain basic theory of stress and strain
3. Solve for direct and sheer stresses components
4. Analyse simple beam stresses
5. Derive stress-strain constants from test diagrams

Course Description

Overview of continuum theory. Qualitative overview of material idealization, elastic, plastic, viscoelastic, viscoplastic and elasto viscoplastic behavior. Material homogeneity, uniformity and isotropy. Tensor notation. Mechanics of materials loading, static and dynamics forces. Analysis of stress. Analysis of strain. Constitutive relations. Stress and strain in tension, compression and shear. Behaviour of materials under static loading, stress-strain diagrams, linear elasticity, tension, instability, elastic constants. Strain energy in tension, compression and shear. Analysis of design in simple tension and compression, non-uniform and thermal stress and strains. Thin-walled pressure vessels, volumetric strain, pressure effects. Elastic torsion analysis, design of shafts, strain energy in torsion. Bending of beams: reaction by supports, shear forces and bending moments. Simple Bending Theory: loading plane, moment plane and neutral axis, constant strength beams. Combined loading applied to design, eccentric loading, combined bending and torsion. Deflection of beams due to pure bending, statically determine beams, moment-area method, strain energy in bending, constant strength beam theory. Built-in and continuous beam analysis. Plane frame analysis.

Mode of Delivery

This course will be taught by using lectures, tutorials and assignments and practical material testing laboratory sessions

Mode of Assessment

This shall be by practicals, assignments, tests and examination. The relative contribution to the final grade will be as shown below

Requirement	**Percentage contribution**
Tests/Assignments/Practicals	40%
Final Examination	60%
Total	100%

Resources

1. Laboratory with material testing machines

2. Literature

Course Textbooks

1. Parviz Ghavami, (2014), *Mechanics of Materials: An Introduction to Engineering Technology*,Springer.
2. C. Hartsuijker, J.W. Welleman (2016), *Engineering Mechanics: Volume 2: Stresses, Strains, Displacements*, Springer.

Reference Textbooks

1. Carl Ross, John Bird, Andrew Little (2016), *Mechanics of Solids,*Routledge.
2. Jacob Lubliner, Panayiotis Papadopoulos (2016), *Introduction to Solid Mechanics: An Integrated Approach*, Springer.

EEEQ204 Thermodynamics 60 hrs, 1.25 units

Purpose:

The course introduces students to the principles and laws of thermodynamics. It covers the basic concepts such as definitions, properties of state and laws as well as thermodynamic processes.

Course learning Objectives/Outcomes

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

1. Define the relevant quantities used in thermodynamics
2. State and apply the first law of thermodynamics
3. Sketch the cycles of different ideal processes
4. Solve the problems related to changes in state related to thermodynamic processes

Course Description

Introduction to thermodynamics: definition of system, property, process, reversible and irreversible processes, cycle. First law of thermodynamics, its application to non-flow and

steady flow processes. Non-flow and steady flow processes. Introduction to steam, properties of steam in liquid, vapour and gaseous forms. Use of steam tables. Second law of thermodynamics; heat engine, entropy, reversibility, and irreversibility. Ideal gas cycles, cycles of operation for internal combustion petrol and diesel engines.

Mode of Delivery

This course will be taught by using lectures, tutorials and assignments and practical thermodynamic laboratory sessions

Mode of Assessment

This shall be by practicals, assignments, tests and examination. The relative contribution to the final grade will be as shown below.

Requirement	**Percentage contribution**
Tests/Assignments/Practicals	40%
Final Examination	60%
Total	100%

Prescribed text books

1. Michael J. Moran , Howard N. Shapiro, Daisie D. Boettner, Margaret B. Bailey, (2014), Fundamentals of Engineering Thermodynamics, Wiley.
2. William D. Ennis M.E. (2015), Applied Thermodynamics for Engineers, CreateSpace Independent Publishing Platform.

References

1. Michael J. M. & Howard N. S. (2014), Fundamentals of Engineering Thermodynamics, Wiley.
2. Juan H. Vera, Grazyna Wilczek-Vera (2016), Classical Thermodynamics of Fluid Systems: Principles and Applications, CRC Press.

Journals

International Ed. International Journal of Fluid and Thermal Engineering Literature.

EEEQ205 Entrepreneurship and Business Development 48 hrs, 1.0 units

Prerequisites

None

Purpose

The aim of this course is to enable the students to;

1. set up and manage small scale enterprises
2. perform financial accounting, budgeting, management and financial analysis
3. be well versed about sound leadership of business setups

Learning Outcomes

At the end of this course, the student should be able to;

1. prepare and understand a profit and loss account and a balance sheet
2. demonstrate the ability to prepare a budget for an engineering/production firm, and identify the various sources of financing such a budget
3. demonstrate the ability to evaluate the performance of a business, using the various analysis ratios

Course Description

Introduction and definition. Linkages between entrepreneurship and engineering: problem solving; planning; systems analysis; can- do attitude. Effecting projects through sales, marketing, planning, staffing, implementation, financing and growth. Survival and success through cash flow management. Human issues in new enterprises. Alignment of interests between providers of value and providers of capital. Transformation of enterprises along growth path. Evolution of design and innovation. Priorities and aims for design and Innovation; Industrial development, Energy to Technology development. Factors in Design and Innovation. Incentives for product design operation, arrangements for cooperate systems. Product Design analysis, Product creation process, Product design processes, engineering the products design.

Design cycle process. Design obsolescence. Design considerations; Safety: Elements and design, alternative. Product tests and Evaluation; Preliminary tests. Elemental functions and standardization and field tests. Product and test analysis. Design cycle of Innovation and Improvement product reporting. Design Project.

Teaching Methodology

3 hour lecture and 1 hour tutorial per week.

Mode of course assessment: Continuous assessment and written University examinations shall contribute 30% and 70%, respectively of the total marks.

Instructional Materials/Equipment

1. Presentation software
2. LCD projector

Course Textbooks

1. Hisrich R. D., Michael P. &Dean A. (2016), *Entrepreneurship*, Boston, McGraw-Hill.
2. Charles Bamford, Garry Bruton(2015), *Entrepreneurship*, McGraw-Hill Education.

Reference Textbooks

1. H. James Harrington, Richard Harrington Jr., Ron Skeddle (2017), Creativity, Innovation, and Entrepreneurship, Productivity Press.
2. Dollinger, Marc J. (2007), *Entrepreneurship: Strategies and Resources, New Jersey*, Prentice Hall.

Reference Journals

EEEQ206 Energy Resources 48 hrs, 1.0 units

Purpose

The aim of this course is to enable the student to:

1. understand power generation from renewable energy sources

2. understand energy storage technologies.

Learning Outcomes

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

1. explain power generation from renewable energy sources
2. explain the impacts of temperature, insolation and shading on I-V curves
3. determine the performance of PVs and wind turbine generators
4. explain energy storage technologies.

Course Description

Conventional energy sources: fossil fuels; biomass; hydropower; nuclear power. Renewable energy sources: solar power; wind power; tidal power; mini and micro-hydro power. Energy uses: domestic, agricultural, industrial, transport, telecommunication, amenity. Energy quantity, quality and availability. Energy conversion. Energy management: energy conservation, energy audit. Energy related incidents. Environmental, economic and social impacts of energy development.

Teaching Methodology: 2 hour lecture and 1 hour tutorial per week and at least three3-hour laboratory sessions per semester organized on a rotational basis

Instruction materials/equipment

1. Electrical Machines Laboratory
2. Projector

Prescribed text books

1. Gilbert M. Masters (2014), Renewable and Efficient Electric Power Systems, Wiley-Interscience, John Wiley & Sons, ISBN: 0471280607

2. J. F. Manwell, J. G. McGowan & A. L. Rogers (2010), Wind Energy Explained: Theory, Design and Application, 2nd Ed., Wiley, ISBN: 0470015004

References

1. The Open University,(2016) Energy resources: Wind energy, The Open University.

2. Roy L. Nersesian,(2016) Energy Economics: Markets, History and Policy, Routledge.Solar Energy, vol.44, no.5, pp. 271-289.

3. Olindo Isabella, Klaus Jäger, Arno Smets, René van Swaaij, Miro Zeman, (2016) Solar Energy: The Physics and Engineering of Photovoltaic Conversion, Technologies and Systems, UIT Cambridge Ltd.

4. Stephen Peake,(2017) Renewable Energy: Power for a Sustainable,Oxford University Press

5. International Journal of Renewable Energy Technology

EEEQ207 Electric Circuit Theory 1A 60 hrs, 1.25 units

Prerequisites

Mathematics 1A

Purpose

The aim of this course is to enable the student to;

1. know how to analyze the sine waves
2. obtain the skill of analyzing three-phase circuits
3. use various network theorems to analyze complex circuits

Learning Outcomes

At the end of this course, the student should be able to;

1. calculate the mean, and r.m.s. values of a sine wave
2. Calculate the circuit parameters of a single and three phase circuits such as equivalent impedances.
3. Reduce complex circuits into simple ones using the various network theorems.

Course Description

Kirchhoff's laws, magnetic circuits, stored energy, magnetic attraction, hysteresis and eddy current, self and mutual inductance, forces between conductors. Electrostatics: permittivity,

capacity, electric stress, stored energy. Circuit theory: Simple dc transient in LR and RC networks, alternating current, resistance, capacitance and inductance, resonance, Q-factor, balanced three phase circuits; simple ac network problems including parallel circuits.

Teaching Methodology

2 hour lectures and 1 hour tutorial per week, and at least five 3-hour laboratory sessions per semester organized on a rotational basis.

Mode of course assessment: Continuous assessment and written University examinations shall contribute 30% and 70%, respectively of the total marks.

Instructional Materials/Equipment

1. Electronics Lab
2. LCD projector

Course Textbooks

1. John Bird,(2017), *Electrical Circuit Theory and Technology*,Routledge.
2. Ozgur Ergul (2017), *Introduction to Electrical Circuit Analysis,*Wiley.

Reference Textbooks

1. G. I. Atabekov (2014), *Linear network theory*, Pergamon Press.
2. S.K. Sahdev (2015), *Basic Electrical Engineering*, Pearson.

Reference journals

1. IEEE Transactions on Circuits and Systems
2. Open Electrical and Electronics Engineering Journal
3. International Journal of Circuit Theory and Application

EEEQ208 Physical Electronics A 60 hrs, 1.25 units

Prerequisites

Physics B

Purpose

The aim of this course is to enable the student to;

1. familiarize with the structure of atoms
2. understand how extrinsic semiconductors are formed from pure semiconductors
3. learn the characteristics and application of various diodes

Learning Outcomes

At the end of this course, the student should be able to;

1. draw the atom structure of various atoms given the atomic number
2. explain the operation and properties of P-N junction
3. use the characteristics of various diodes to explain their applications.

Course Description

The atomic structure: the Bohr atom, quantum theory, hydrogen atom, electron spin, the periodic system; the Maxwell-Boltzmann distribution, Fermi-Dirac distribution; excitation, ionization, absorption and emission of radiation; atomic magnetization. Atomic bonding: forces between atoms; crystal structure and bond types - ionic, covalent, metallic and Van der Waal; cohesion in crystals, quantum-mechanical approach, covalent crystals, metallic crystals. Conduction in metals: free electronic theory-classical and Sommerfeld theory. Momentum space, electrical conductivity of metals, zone theory. Kronig-Penny model, allowed energy zones, density of states. Energy levels and bands. Electron emission and vacuum devices: work function, contact potential, thermionic emission. Richardson's equation and emission constants, Schottky effect. Field emission, secondary emission and photoelectric emission. The triode, tetrode and pentode.

Teaching Methodology

2 hour lectures and 1 hour tutorial per week, and at least five 3-hour laboratory sessions per semester organized on a rotational basis.

Mode of course assessment: Continuous assessment and written University examinations shall contribute 30% and 70%, respectively of the total marks.

Instructional Materials/Equipment

1. Presentation software
2. LCD projector

Course Textbooks

1. Jorgen Rammer,(2017)*Physics of Electronic Materials: Principles and Applications,*Cambridge University Press.
2. David W. (2014), *Electronics: A Physical Approach*, Pearson.

Reference Textbooks

1. D. Chattopadhyay (2006), *Electronics (fundamentals And Applications)*, New Age International.
2. Massimo Rudan (2016), *Physics of semiconductor devices,*Springer.
3. Peter Lynch & Anthony Nicolaides (1972), *Worked Examples in Physical Electronics*, Harrap, illustrated Ed.

Semester II

EEEQ209 Mathematics II B 48 hrs, 1.0 units

Prerequisites

Mathematics II A

Purpose

The aim of this course is to enable the student to;

1. understand differential calculus
2. learn partial differentiation including first and second partial derivatives and total derivatives
3. appreciate improper and double integrals.

Learning Outcomes

At the end of this course, the student should be able to;

1. understand the concepts of differential calculus including their application to engineering problems
2. understand the concepts of partial differentiation
3. apply integration techniques in determining arc length, plane and surface area, volume, mass centre and moments of inertia of various bodies.

Course Description

The Laplace transform: the Laplace and inverse-Laplace transform; Laplace transform solution of initial value problems; shifting theorems and the Heaviside function; the convolution theorem; the Dirac delta function; Laplace transform solution of the systems of equations. Sturm-Liouville theory: eigenfunction expansions; special functions- Legendre's equation and Legendre polynomials, Bessel equations and Bessel functions. Fourier analysis: Fourier series and integrals; Fourier transforms- the Fourier transform, the discrete Fourier transform, the fast Fourier transform, Fourier sine and cosine transforms. Complex analysis: complex numbers and complex functions; derivatives of complex functions; polynomials, rational functions, and

power series; exponential and trigonometric functions; the complex algorithm; powers; integration of complex functions; series representation of functions; singularities and residue theorem. Conformal mappings: functions as mappings; conformal mappings and linear fractional transformations; construction of conformal mappings between domains; harmonic functions and the Dirichlet problem.

Teaching Methodology

3 hour lectures and 1 hour tutorial per week.

Mode of course assessment: Continuous assessment and written University examinations shall contribute 30% and 70%, respectively of the total marks.

Instructional Materials/Equipment

1. Presentation software
2. LCD projector

Course Textbooks

1. John Bird.(2014) *Engineering Mathematics*, Routledge.
2. Philip Brown (2016), *Foundations of Mathematics: Algebra, Geometry, Trigonometry and Calculus, Mercury* Learning & Information.
3. Jeffrey A. (2004) *Mathematics for Engineers and Scientists*, Chapman & Hall, 4th Ed.

Course Journals

Reference Textbooks

1. Spiegel, M. R. (2009) *Schaum's Outline of Advanced Mathematics for Engineers and Scientists*, McGraw-Hill.
2. Polyanin A. D. & Manzirov A. V. (2006) *Handbook of Mathematics for Engineers and Scientists*, Chapman & Hall/CRC Press.
3. Jerrold E Marsden, Alan Weinstein (2013), *Calculus I, II, III*, John Wiley & Sons.

Reference Journals

EEEQ210 Introduction to Electrical Engineering 36 hrs, 0.75 units

Prerequisites

- Introduction to engineering
- Physics
- Biology
- Communication skills

Purpose

The aim of this unit is to enable the learner to:

1. Relate pioneers of the field to the present engineering
2. acknowledge contemporary issues within and outside the electrical engineering profession.
3. be conversant with the various professional bodies concerned with electrical
4. use the techniques, skills, and modern engineering tools necessary for electrical engineering practice.

Learning outcomes

At the end of this unit learner should be able to:

1. Define voltage, current, and resistance.
2. Identify nodes and branches in a circuit.
3. Distinct the various types of energy sources, transmission and distribution methods

Course description

History of Electricity. Electricity and development. Scope of electrical and electronic engineering, fields of specialization; international variation in specialization; emerging areas in electrical and electronic engineering. Tools of electrical engineering. Economics and social elements in electrical and electronic engineering. Professional societies and registration. The future of the profession. The course shall comprise visits to relevant industries and students

shall be expected to write reports out of such visits; the reports shall comprise part of the coursework for the course.

Teaching Methodology

Lecture: 3, Tutorial: 1, Lab: 2 hour Lab sessions organised on rotational basis per group (Hours/week)

Modes of course assessment

Coursework for the unit shall be by continuous assessment and shall be defined as comprising assignments and continuous assessment tests and University examination to contribute 40% and 60% respectively for the total marks.

Instructional materials/Equipment

- Physics Lab
- Overhead projector
- Lecture room

Reference Textbooks

1. Rajendra Prasad,(2014) Fundamentals of Electrical Engineering, Prentice-Hall of India Pvt.Ltd.
2. André Koch Torres Assis,(2010) The experimental and historical foundations of electricity, C. Roy Keys Inc.
3. David V. Kerns Jr. & J. David Irwin, (2015) Essentials of Electrical and Computer Engineering, Prentice Hall.

Course Textbooks

1. A.S. Sedra and K. C. Smith,(2014) Microelectronic Circuits, Oxford University Press.
2. K.C. Smith, KC's (1998) Problems and Solutions for Microelectronic Circuits, Oxford University Press.
3. Bird, J. (2017)Electrical Circuit Theory and Technology, Published by Elsevier.
4. C.Allen (2016) Introduction to electronic engineering, Ventus publishing AP.

EEEQ211 Mechanics of Machines 60 hrs, 1.25 units

Prerequisite

EEEQ 203 Solid and Structural Mechanics

Purpose

This course introduces the student to the analysis of machines commonly used in mechanical engineering. The course deals with evaluation of velocity, acceleration, forces and torque associated with the performance of the machines.

Learning Outcomes

By the end of this course, the student should be able to

1. analyze motion of elements of different mechanisms
2. construct and solve mathematical models which describe the effects of force and motion on a variety of mechanisms and machines that are of concern to mechanical engineers.
3. Appreciate the relevance of the study of Mechanical systems to electrical Engineers

Course Description

Location of rigid bodies: kinematic constraint, degree of freedom of translation rotation, surface, line and point contact. Kinematics of plane mechanisms: definition of pair kinematic chain, mechanism, machine, inversion, various type of mechanism; velocity and acceleration diagram; cams. Dynamics and forces in plane mechanism: inertia forces, dynamics of rigid bodies, force analysis of a simple crank-slider engine mechanism, engine torque diagrams, flywheel inertia. Friction and lubrication: surface contact, fluid film lubrication, hydrostatic bearings, anti-friction bearings. Mechanical power transmission: flat belt and V-belt drives, chain drives, gear strain, gearboxes, friction clutches, Hooke's joint and constant velocity joint. Balancing of rotating systems: balancing in one and two planes, moment and force vector diagram, practical balancing machines. The gyroscopic effect: gyroscopic couples for high-speed discs, the gyroscope.

Teaching Methodology

2 hour lectures and 1 hour tutorial per week, and at least five 3-hour laboratory sessions per semester organized on a rotational basis.

Mode of course assessment: Continuous assessment and written University examinations shall contribute 30% and 70%, respectively of the total marks.

Instructional Materials/Equipment

1. Presentation software
2. LCD projector

Textbook:

1. K. J. Waldron and G. L. Kinzel (2016) Kinematics, Dynamics, and Design of Machinery, John Wiley.
2. Erik Oberg, (2016) Machinery's Handbook, Industrial Press.

References:

R. Norton (2013) Design of Machinery,McGraw Hill.

EEEQ212 Material Science 60 hrs, 1.25 units

Prerequisites

EEEQ112 Chemistry B

Purpose

The aim of this course is to enable the student to;

1. understand electrical properties of different materials
2. understand the etching and cleaning process

Learning Outcomes

At the end of this course, the student should be able to;

1. use electrical materials in design of different electrical electronic devices
2. design etch and effectively clean circuit boards

Course Description

Crystal structure and bonding in metals, alloys, ceramics, glasses and polymer. Macro and micro structures of materials and properties. Solidification of metals and alloys. Equilibrium diagrams, heat treatment and thermo – mechanical treatment. Composite materials. Mechanical properties: stress deformation, proof stress, tensile strength, shear strength, hardness, ductility, toughness. Ductile–brittle transition. Fracture toughness. Strengthening methods. Importance of crystal structure in determining properties. Chemical properties: corrosion, photo damage, testing and physical examination of materials. Non-destructive testing. Electrical and magnetic properties of engineering materials; metals, ceramics, polymers, and industrial applications.

Teaching Methodology

2 hour lectures and 1 hour tutorial per week, and at least five 3-hour laboratory sessions per semester organized on a rotational basis.

Mode of course assessment: Continuous assessment and written University examinations shall contribute 30% and 70%, respectively of the total marks.

Instructional Materials/Equipment

1. Presentation software
2. LCD projector

Course Textbooks

1. Charles Gilmore,(2014)*Materials Science and Engineering Properties,* Cengage Learning.
2. James F. Shackelford (2014)*Introduction to Materials Science for Engineers,* Pearson.

Course Journals

Reference Textbooks

1. William F. Hosford (2011), *Materials science: an intermediate text*, Cambridge University Press, illustrated Ed.
2. William D. Callister, (2014), *Materials Science and Engineering*, John Wiley & Sons Inc.

Reference Journal

EEEQ213 Electric Circuit Theory IB 60 hrs, 1.25 units

Prerequisites

EEEQ207 Electric Circuit Theory 1A

Purpose

The aim of this course is to enable the student to;

1. Use differential equation to analyze circuit dynamics
2. Familiarize themselves with Fourier and Laplace transforms and apply them in solving circuits
3. Analyze the RLC circuits and their stability using the Fourier and Lapse transforms

Learning Outcomes

At the end of this course, the student should be able to;

1. Obtain circuit parameters of dynamic circuits using differential equations
2. Solve dynamic circuits using Fourier and Laplace transforms.
3. Obtain the frequency response, resonance and selectivity of RLC circuits.

Course Description

Network classification & Introduction to continuous time signals and systems. Unit Step, ramp and impulse signals, Example of each signal, Differential Equation Formulation of linear time invariant continuous system, Responses for unit ramp, square pulse and impulse function . Review of Laplace Transform. Initial value and Final Value Theorem, Properties and solution of differential equation using LT, Time domain analysis of LTI network using Laplace transform, Waveform Synthesis, LT of Complex waveforms, Concept of Transform Impedance, voltage ratio, transfer function, Relation between impulse response and system function. Networks

Theorems: Maximum power transfer Theorem, Superposition, Telligen's, Milliman's, Thevenin's and Norton's Theorem, Concept of poles and zeros, Relation between location of poles, time response and stability. Two port networks: two port network parameters (z, y, T, T', h, g), Symmetrical & Reciprocal networks, Inter-conversion of two port network parameters, Interconnection of two port networks, ,Ladder networks, T-□ transformation.

Teaching Methodology

2 hour lectures and 1 hour tutorial per week, and at least five 3-hour laboratory sessions per semester organized on a rotational basis.

Mode of course assessment: Continuous assessment and written University examinations shall contribute 30% and 70%, respectively of the total marks.

Instructional Materials/Equipment

1. Electronics Lab
2. LCD projector

Course Textbooks

1. V.K. Aatre, (2014) *Network theory and filter design*, New Age International.
2. A.V.Bakshi U.A.Bakshi (2008), *Network Theory*,Technical Publications.
3. Ernesto Estrada, Philip Knight, (2015)*A First Course in Network Theory,*Oxford University Press.

Course Journals

Reference Textbooks

1. G. I. Atabekov (2014), Linear network theory, Pergamon Press.
2. S.K. Sahdev (2015), Basic Electrical Engineering, Pearson.

Reference Journals

1. IEEE Transactions on Circuits and Systems
2. Open Electrical and Electronics Engineering Journal
3. International Journal of Circuit Theory and Applications

EEEQ214 Physical Electronics B 60 hrs, 1.25 units

Prerequisites

Physical Electronics A

Purpose

The aim of this course is to enable the student to;

1. be familiarize with the construction of a solar cell.
2. understand the operation of LED and photo diodes
3. learn how to derive equations governing FET.

Learning Outcomes

At the end of this course, the student should be able to;

1. draw circuit diagram and explain the operation of a solar cell.
2. explain the operation of transistors on the basis of energy band
3. calculate the FET parameters using the appropriate equations.

Course Description

Solar cell: physical processes involved in photovoltaic effect. Solar spectrum: dispersion of light in semiconductors in relation to energy gap. Solar cell characteristics. Light emitting diodes(LED) : generation of electromagnetic (EM) radiation by p-n junction. Semiconductor laser photo diodes, photo transistors, and liquid crystal displays. Transistors action on the basis of energy band diagrams. Derivation of equations on the basis of energy band diagrams. Derivation of FET equation. MOSFET, VeSFET and their characteristics. Ideal and non-ideal behaviour of these devices.

Teaching Methodology

2 hour lectures and 1 hour tutorial per week, and at least five 3-hour laboratory sessions per semester organized on a rotational basis.

Mode of course assessment: Continuous assessment and written University examinations shall contribute 30% and 70%, respectively of the total marks.

Instructional Materials/Equipment

1. Electronics Lab
2. LCD projector

Course Textbooks

1. David K. Ferry, D. Ronald Fannin (1971), *Physical electronics*,Addison-Wesley.
2. J. Seymour (1972), *Physical Electronics: Introduction to the Physics of Electron Devices*, Pitman Publishing, abridged.

Course Journals

1. IET Optoelectronics
2. Physics of the Solid State

Reference Textbooks

1. Aldert Van der Ziel (1976), *Solid State Physical Electronics*, Prentice Hall, 3rd Ed.
2. Massimo Rudan,(2015), *Physics of Semiconductor Devices,*Springer.

Reference Journals

1.Solid-State Electronics

2.Semiconductor Physics, Quantum Electronics and Optoelectronics

EEEQ215 Instrumentation and Measurement 60 hrs, 1.25 units

Prerequisites

Physics B

Purpose

The aim of this course is to enable the student to;

1. understand the concept of international Standards of Units
2. understand the working principle of electrical/instruments and transducers

Learning Outcomes

At the end of this course, the student should be able to;

1. use different instruments to perform various measurements
2. store, process and analyze data obtained from measurements

Course Description

Elements of measurement systems: Accuracy, precision and sensitivity of instruments. Calibration and errors in measuring instruments. Statistical analysis of measurement data. Electrical and Mechanical measurements. Analogue instruments and digital instruments. Measurement of current, voltage, resistance, frequency and power AC/DC bridges. Transducers: types-resistive, capacitive, inductive, optical, thermal and piezoelectric, photovoltaic display devices. Measurement of mass, volume and area. Measurement of time, displacement, speed, acceleration and frequency; strain, force, torque, power and pressure; vibration; temperature and fluid flow.

Teaching Methodology

2 hour lectures and 1 hour tutorial per week, and at least five 3-hour laboratory sessions per semester organized on a rotational basis.

Mode of course assessment: Continuous assessment and written University examinations shall contribute 30% and 70%, respectively of the total marks.

Instructional Materials/Equipment

1. Electronics Lab
2. LCD projector

Course Textbooks

1. Robert B. Northrop, (2014) *Introduction to Instrumentation and Measurements*, CRC Press.
2. Francis S. Tse, Ivan E. Morse (1989), *Measurement and instrumentation in engineering: principles and basic laboratory experiments*,CRC Press, illustrated Ed.
3. Alan S. Morris (2015), *Measurement and instrumentation principles*, Elsevier.

Reference Textbooks

1. Robert B. Northrop (2014), *Introduction to instrumentation and measurements*, CRC Press.
2. Rohit Khurana (2016), *Electronic instrumentation and measurements*, Vikas.

Reference Journals

1. IEEE Transactions on Industrial Electronics and Control Instrumentation
2. Acta Electrotechnica
3. IEE Proceedings - Part A: Physical Science, Measurements and Instrumentation, Management and Education, Reviews
4. Sensors and Actuators A: Physical
5. Remote Sensing of Environment

EEEQ216 Electrical Energy Systems 60 hrs, 1.25 units

Purpose

The aim of this course is to enable the student to:

1. understand electrical power generation from conventional and renewable energy sources

2. understand electrical energy storage technologies.

Learning Outcomes

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

1. explain electrical power generation from conventional and renewable energy sources

2. explain the economics of electrical power generation

3. determine the performance of PVs and wind turbine generators

4. explain energy storage technologies.

Course Description

Economics of generation: load duration curve, demand and diversity factors, plant capacity and plant use factors , choice of type of generation, choice of size and number of units, cost of energy generated, tariffs. Thermal and hydro power systems: comparison of power systems, layout and working of steam, diesel, low and high head hydro power plants, pumped storage plants. Economic operation of steam hydro plants, interconnected operations, division of load in interconnected system, economic loading of steam and hydro power plants. Nuclear power plants: Principle of power generation, location, advantages and disadvantages of nuclear power plants, reactor control, reactor safety, waste disposal. Non-conventional power plants: Basic concepts, principle of working and layout of solar, wind, tidal, biomass, geothermal and emerging cases.

Teaching Methodology: 2 hour lecture and 1 hour tutorial per week and at least three3-hour laboratory sessions per semester organized on a rotational basis

Instruction materials/equipment

1. Electrical Machines Laboratory
2. Projector

Prescribed text books

1. Gilbert M. Masters (2014), *Renewable and Efficient Electric Power Systems*, John Wiley & Sons.
2. J. F. Manwell, J. G. McGowan & A. L. Rogers (2010), Wind Energy Explained: Theory, Design and Application, Wiley.

References

1. The Open University, (2016) Energy resources: Wind energy, The Open University.
2. Roy L. Nersesian, (2016) Energy Economics: Markets, History and Policy, Routledge

3. Olindo Isabella, Klaus Jäger, Arno Smets, René van Swaaij, Miro Zeman, (2016) Solar Energy: The Physics and Engineering of Photovoltaic Conversion, Technologies and Systems, UIT Cambridge Ltd.
4. Stephen Peake, (2017) Renewable Energy: Power for a Sustainable, Oxford University Press

Journals

International Journal of Renewable Energy Technology

(c) Year III

Semester I

EEEQ301 Workshop Practice (Internal Attachment) 12 Weeks (432 hrs), 4.5 units

Purpose

The aim of this course is to enable the student to;

1. understand operation in workshop of the various engineering fields
2. learn operation of basic machine tools

Course Objectives

At the end of this course a student should be able to:

1. Identify and correctly use different manual workshop tools
2. Operate the basic machine tools (lathe, milling machine, drill, welder, tool grinder, etc)
3. Explain and implement different types of house wiring
4. Explain and implement different sub-assemblies of an automobile

Course Description

An exposure to operation in workshops in the various fields of engineering including electrical and electronic engineering, mechanical engineering, civil engineering, geospatial engineering, automotive engineering, and aeronautical engineering. This course shall be graded by coursework

Part I

Engineering Design and safety: safety organization and planning, safety inspections, prevention of accidents. Bench work and marking out: use of marking-off table and instruments e.g. scribers, height gauge etc. Basic operation of machine tools; centre lathe, milling machine, drilling machines, shaping and slotting machines, grinding machines etc. Metal joining: riveting, welding, soldering etc.

Part II

Electrical symbols, circuit diagrams layout, documentation. Electrical wiring, tinning and plating. Use of stock and dies, threading and joining of galvanized mild steel pipes, cutting and joining techniques, pipe bending, spring, machine bending etc. Exposure to operations in civil engineering works and engineering surveying.

Mode of Delivery

This will be conducted through short briefing sessions and instruction followed by three or four sessions of hands-on practice

Mode of assessment

Each student is assessed on each element on the basis of the following

Practical Exercises (objects made, weld joints, identification of tools etc)	70%
Written workshop report	30%
Total	100%

Semester II

EEEQ302 Linear Algebra 48 hrs, 1.0 units

Prerequisites

Mathematics II B

Purpose

The aim of this course is to enable the student to;

1. understand differential calculus
2. learn partial differentiation including first and second partial derivatives and total derivatives
3. appreciate improper and double integrals.

Learning Outcomes

At the end of this course, the student should be able to;

1. understand the concepts of differential calculus including their application to engineering problems
2. understand the concepts of partial differentiation
3. apply integration techniques in determining arc length, plane and surface area, volume, mass centre and moments of inertia of various bodies.

Course Description

Vector spaces: representation of vectors; vector spaces and sub spaces; linear combination and systems equations; linear dependence and independence; bases and dimension; maximal linearly. Independent subsets. Linear transformations and matrices: linear transformations, null spaces, and ranges; the matrix representation and isomorphism; the change of coordinate matrix; dual spaces; homogeneous linear differential equations with constant coefficients. Elementary matrix operations and systems of linear equations: elementary matrix operations and elementary matrices; the rank of a matrix inverses; systems of linear equations. Determinants: determinants of order-2; determinants of order n; properties of determinants; characterization of the determinant. Diagonalization: eigen values and eigenvectors; diagonalizability; matrix limits and Markov chains; invariant subspaces and Cayley-Hamilton theorem. Inner product spaces: inner products and norms; Gram-Schmidt orthogonalization process and orthogonal complements; the adjoint of a linear operator; normal and self-adjoint operators; unitary and orthogonal operators and their matrices; orthogonal projections and the spectral theorem; bilinear and quadratic forms; conditioning and the Rayleigh quotient; the geometry of orthogonal operators. Canonical forms; the minimal polynomial; rational canonical form.

Teaching Methodology

3 hour lectures and 1 hour tutorial per week.

Mode of course assessment: Continuous assessment and written University examinations shall contribute 30% and 70%, respectively of the total marks.

Instructional Materials/Equipment

1. Presentation software
2. LCD projector

Course Textbooks

4. John Bird.(2014) *Engineering Mathematics*, Routledge.
5. Philip Brown (2016), *Foundations of Mathematics: Algebra, Geometry, Trigonometry and Calculus, Mercury* Learning & Information.
6. Jeffrey A. (2004) *Mathematics for Engineers and Scientists*, Chapman & Hall, 4th Ed.

Reference Textbooks

4. Spiegel, M. R. (2009) *Schaum's Outline of Advanced Mathematics for Engineers and Scientists*, McGraw-Hill.
5. Polyanin A. D. & Manzirov A. V. (2006) *Handbook of Mathematics for Engineers and Scientists*, Chapman & Hall/CRC Press.
6. Jerrold E Marsden, Alan Weinstein (2013), *Calculus I, II, III*, John Wiley & Sons.

EEEQ303 Geometry **48 hrs, 1.0 units**

Prerequisites

None

Purpose

The aim of this course is to enable the student to;

1. learn basic geometry
2. understand general presentation of equations of various geometries in various coordinate systems
3. be introduced to applications of trigonometry

Learning Outcomes

At the end of this course, the student should be able to;

1. solve and manipulate various trigonometric equations and identities
2. relate Cartesian coordinates to polar coordinates for general equations representing circles, ellipses, parabolas and hyperbolas
3. solve various engineering problems using trigonometry as a tool

Course Description

A review of linear algebra: linear systems and methods for solution of systems of linear equations; linear spaces; the method of least squares. Images and projections: parallel projections - projection of a fixed object into a fixed image plane; projections of moving objects; perspective drawings; the mapping matrix; reconstruction of 3D-objects from perspective images. Affine geometry: the affine space; the barycentric calculus; affine maps; affine figures; quadrics in affine spaces and affine quadrics; homothetic pencils. Euclidean geometry: the Euclidean space; Euclidean figures; quadrics in Euclidean space; focal properties. Projective geometry: the projective space; projective maps; projective figures; projective quadrics. Descriptive geometry: associated projections; penetrations. Algebraic geometry: implicit curves and surfaces; parametric curves and surfaces; elimination methods; implicitization, inversion and intersection. Differential geometry: curves; curves on surfaces; surfaces. Introduction to Non-Euclidean geometry.

Teaching Methodology

3 hour lectures and 1 hour tutorial per week

Mode of course assessment: Continuous assessment and written University examinations shall contribute 30% and 70%, respectively of the total marks.

Instructional Materials/Equipment

1. Presentation software
2. LCD projector

Course Text Books

1. Frederick S. Woods, Frederick H. Bailey, (2014), *Analytic Geometry and Calculus,* Literary Licensing.
2. L Bostock, F S Chandler,(2014), *Pure Mathematics,* Oxford University Press.

Course Journals

1. SIAM Journal on Applied Mathematics
2. Communications in Applied Geometry

Reference Textbooks

1. W. A. Wilson and J. I. Tracey,(2016), *Analytic Geometry*, Leopold Classic Library.
2. Hodge W. V. D. & Pedoe D. (1994), *Methods of Algebraic Geometry, Bi-rational geometry,* Cambridge University Press
3. Marsh, Duncan (2005), *Applied Geometry for Computer Graphics and CAD,* Springer

Reference journals

1. Journal of Applied Mathematics and Physics
2. Illinois Journal of Mathematics
3. International Journal of Mathematics

EEEQ304 Electric Circuit Theory IIA 60 hrs, 1.25 units

Prerequisites

Electric Circuit Theory 1B

Purpose

The aim of this course is to enable the student to;

1. Use differential equation to analyze circuit dynamics
2. Familiarize themselves with Fourier and Laplace transforms and apply them in solving circuits
3. Analyze the RLC circuits and their stability using the Fourier and Lapse transforms

Learning Outcomes

At the end of this course, the student should be able to;

1. Obtain circuit parameters of dynamic circuits using differential equations
2. Solve dynamic circuits using Fourier and Laplace transforms.
3. Obtain the frequency response, resonance and selectivity of RLC circuits.

Course Description

Generation: Types of power plant, functional block diagram of generating stations (hydro and thermal stations). Transmission: standards (AC and DC), substations, grid. Distribution: industrial, commercial and domestic standards. Utilization: types of loads, UPS and domestic inverters. Domestic wiring: materials, accessories and ratings of the wiring materials, types of wiring: stare case, fluorescent tube and simple domestic wiring layout, earthing and electricity rules. Steady-state analysis of AC circuits: sinusoidal and phasor representation of voltage and current, single phase ac circuit behavior of R, L and C. Combination of R, L and C in series and parallel. Resonance. Three phase AC circuits: line and phase voltage/current relationship for star & delta connections. Measuring instruments: types of instruments, working principles of ammeter, voltmeter, wattmeter and energy meter. Transformer and rotating machines: principle of operation and construction of single-phase transformer, phasor diagram and equivalent circuits, efficiency and voltage regulation. Principle of electromagnetic energy conversion, starting and speed control of DC and AC motors.

Teaching Methodology

2 hour lectures and 1 hour tutorial per week, and at least five 3-hour laboratory sessions per semester organized on a rotational basis.

Mode of course assessment: Continuous assessment and written University examinations shall contribute 30% and 70%, respectively of the total marks.

Instructional Materials/Equipment

1. Electronics Lab
2. LCD projector

Course Textbooks

1. V.K. Aatre, (2014) *Network theory and filter design*, New Age International.
2. A.V.Bakshi U.A.Bakshi (2008), *Network Theory*,Technical Publications.
3. Ernesto Estrada, Philip Knight, (2015) *A First Course in Network Theory,* Oxford University Press.

Reference Textbooks

1. G. I. Atabekov (2014), Linear network theory, Pergamon Press.
2. S.K. Sahdev (2015), Basic Electrical Engineering, Pearson.

Reference Journals

1. IEEE Transactions on Circuits and Systems
2. Open Electrical and Electronics Engineering Journal
3. International Journal of Circuit Theory and Applications

EEEQ305 Analogue Electronics A 60 hrs, 1.25 units

Prerequisites

Physical Electronics B

Purpose

The aim of this course is to enable the student to;

1. understand the concept of conduction in gases, liquids and solids
2. understand construction, operation and application of BJTs, FETs and basic rectifiers

Learning Outcomes

At the end of this course, the student should be able to;

1. design and construct a simple single stage amplifiers
2. design AC rectifiers

Course Description

Characteristics of PN-junction. PN-junction diodes. Zener diodes. Rectification. Transistor characteristics and biasing. Bipolar junction transistor amplifiers (Common Base, Common Emitter, Common Collector). Field effect transistors: Biasing and Equivalent Circuits, FET amplifiers (Common Gate, Common Source, Common Drain): two-port representation of a transistor; H parameters and their determination. Analysis of transistor amplifiers using h-parameters; field effect transistor amplifier resistor-capacitor coupled amplifier and its frequency responses; feedback in amplifiers effects of negative feedback; positive feedback and oscillations-Hartley and Colpitts's oscillators. Large signal amplifiers: analysis of class A, B, AB and C amplifiers (push-pull and complementary symmetry circuits), power gain and efficiency, estimation of distortion. Thermal variation and device parameters. Design of power amplifiers. Noise in amplifiers; noise sources, types, signals/noise ratio, common electronic circuits. Pulse amplifiers: charge control model, rise time, fall time compensation techniques, cascaded states, radio frequency amplifier models and use of admittance, miller effect, analysis of broad amplifiers for various circuits configuration design of R.F. tuned and pulse amplifier.

Teaching Methodology

2 hour lectures and 1 hour tutorial per week, and at least five 3-hour laboratory sessions per semester organized on a rotational basis.

Mode of course assessment: Continuous assessment and written University examinations shall contribute 30% and 70%, respectively of the total marks.

Instructional Materials/Equipment

1. Presentation software
2. LCD projector

Course Textbooks

1. Partha K. Ganguly (2015*), Principles of electronics*,PHI Learning.
2. Jimmie J. Cathey (2002), *Schaum's Outline of Theory and Problems of Electronic Devices and Circuits*, McGraw-Hill, 2nd Ed.

Reference Textbooks

1. Robert L. Boylestad & Louis Nashelsky (2015), *Electronic devices and circuit theory*, Prentice-Hall, 3rd Ed.
2. B L Theraja (2007), *Basic Electronics: Solid State*, S. Chand & Company, 4th Ed.

Reference journals

1. Journal of Electronic Science and Technology
2. Active and Passive Electronic Components
3. Electronics and Communications in Japan (Part II: Electronics)

EEEQ306 Programming and Simulation 60 hrs, 1.25 units

Prerequisites

EEEQ118 Computer Science B

Purpose

The aim of this course is to enable the student to;

1. understand the basic concepts of programming

2. be equipped with knowledge of writing programs
3. be introduced to the C language

Learning Outcomes

At the end of this course, the student should be able to;

1. understand the concepts and principles of good programming practices and techniques.
2. understand algorithmic problem solving processes and basic structure of a program,
3. use basic fundamental data types and control structures and how to break a large problem into smaller parts.

Course Description

Writing a Simple Program: Learning the format of a C program, declaring variables, designing program flow and control, defining and using functions, using standard terminal I/O functions. Fundamental data types and storage Classes: character types, integer, short, long, unsigned, single and double-precision floating point, storage classes, automatic, register, static and external. Operators and expressions: using numeric and relational operators, mixed operands and type conversion, logical operators, Bit operations, operator precedence and associativity. Conditional program execution: applying if and switch statements, nesting if and else, restrictions on switch values, use of break and default with switch. Program loops and iteration. Uses of while, do and for loops, multiple loop variables, assignment operators, using break and continue. Modular programming: passing arguments by value, scope rules and global variables, separate compilation, and linkage, building your own modules. Basic simulation Modeling: Discrete-event simulation of a single-server. Queuing, alternative approaches to modeling and coding simulations, Parallel and distributed simulation, simulation across the internet and Web-based simulation. Advantages, disadvantages, and pitfalls of simulation. A simple simulation language: Simlib, single-server, queueing, simulation with Simlib. Time-shared computer model, Job-Shop code efficient event-list manipulation. Simulation software: building valid, credible, and appropriately. Detailed simulation models. Experimental design, sensitivity, analysis and optimization. Simulation of manufacturing systems.

Teaching Methodology

2 hour lectures and 1 hour tutorial per week, and at least five 3-hour laboratory sessions per semester organized on a rotational basis.

Mode of course assessment: Continuous assessment and written University examinations shall contribute 30% and 70%, respectively of the total marks.

Instructional Materials/Equipment

1. Computer Lab
2. LCD projector

Course Textbooks

1. Bjarne Stroustrup,(2014) The C++ Programming Language, Addison-Wesley Professional
2. Jayasri J. (2002), *The C Language Trainer With Graphics and C++*, New Age International (p) Ltd.
3. D. S. Malik,(2014) C++ Programming: Program Design Including Data Structures, Course Technology.

Reference Textbooks

1. Marc Rawen,(2016) Programming,CreateSpace Independent Publishing Platform.
2. Douglas B., (1995), *From Pascal to C: Introduction to the C Programming Language*, Wadsworth Pub. & Co.
3. Balagurusam E. (2016), *Programming in ANSI C*, Tata McGraw-Hill
4. Darrel L. Graham, (2016),*C Programming Language*, CreateSpace Independent Publishing Platform.

EEE Q307 Electromagnetic Fields A 48 hrs, 1.0 unit

Prerequisites

Physics B

Mathematics II B

Purpose

The aim of this course is to enable the student to;

1. distinguish vector fields from scalar fields.
2. appreciate charges and current as sources of electric and magnetic fields.
3. solve simple problems involving electric and magnetic fields penetrating boundaries of different media
4. derive Maxwell's equations from the basic laws of electricity and magnetism.

Learning Outcomes

At the end of this course, the student should be able to;

1. carry out analysis relating to electric and magnetic fields using the classical laws of electricity and magnetism.
2. acquire basic understanding of the principles of electromagnetic theory and their application to modern science and technology.

Course Description

Vector operators; vector algebra; the gradient; invariance of the operator; flux; the divergence; the Laplacian's operator; orthogonal curvilinear coordinates; the curl; phasors; solving a second-order differential equation with phasors. Electric fields: static and steady electric fields. Coulomb's law, the principle of superposition, Gauss' law, Divergence theorem relating volume function to surface function; Stokes' theorem. Time varying electric fields, static magnetic fields. Laplace and Poisson equations for time-dependent electric fields. The law of conservation of electric charge; Conduction in an alternating electric field, electric dipoles, Magnetic circuits. Lorentz's force law; Hall effect. Biot-Savart law and Ampere circuital law. The magnetic force between two closed circuits. Time dependent electromagnetic fields. Boundary conditions in electromagnetic fields. Energy considerations in magnetic circuits.

Teaching Methodology

2 hour lectures and 1 hour tutorial per week, and at least five 3-hour laboratory sessions per semester organized on a rotational basis.

Mode of course assessment: Continuous assessment and written University examinations shall contribute 30% and 70%, respectively of the total marks.

Instructional Materials/Equipment

1. Telecommunication Lab
2. LCD projector

Course Textbooks

1. Norman Violette,(2014), *Electromagnetic Compatibility*, Springer.
2. Fawwaz T. Ulaby, Umberto Ravaioli, (2014) *Fundamentals of Applied Electromagnetics*, Pearson.
3. Sadiku, Matthew (2014), *Elements of Electromagnetics*, New York: Saunders.

Course Journals

Reference Textbooks

1. Bhag S. Guru, Hüseyin R. Hızıroğlu (2009) *Electromagnetic field theory fundamentals*, Cambridge University Press.
2. Rohit Khurana, (2016), *Electromagnetic Field Theory,* Vikas*.*
3. Joseph A. Edminister (1994), *Schaum's Outline of Theory and Problems of Electromagnetics*, McGraw-Hill, 2nd Ed.

Reference Journals

EEEQ308 DC Machines and Transformers 60 hrs, 1.25 units

Prerequisites

EEEQ339 Electromagnetic Fields

Purpose

The aim of this course is to enable the student to;

1. know how to wind, connect and operate a three-phase transformers
2. learn how to do parallel and load sharing on three-phase transformers
3. learn the operation and performance characteristics of three-phase induction motors
4. acquire the skill of testing both the three-phase transformer and motor

Learning Outcomes

At the end of this course, the student should be able to;

1. identify, connect and test a three-phase transformer
2. perform a parallel and load testing of a three-phase transformer
3. describe the operation and explain the operation of a three-phase induction motors
4. practically start, break and test a three-phase and a single phase induction motor.

Course Description

DC machines: construction, emf. and torque equations. Performance characteristics of separately excited, shunt, series and compound machines. DC motors, necessity of a starter, construction of a starter, current variation during starting, speed control by variation of armature voltage and field current. Armature reaction, effect of brush shift. Calculation of magnetising and cross-magnetising ampere-turns. DC machines: heating, rating, losses, power flow, efficiency, braking. Applications of DC machines. Speed-power; load requirements. DC machine windings. Single phase transformers-Construction and windings, equivalent circuits, phasor diagram. Analysis of operation, rating, heating, cooling, losses, temperature rise, efficiency, parallel operation. Parameter determination. Three Phase Transformer: construction and windings, equivalent circuit. Phasor diagrams, methods of connection. Analysis of operation, parallel operation, Scott connection, operation on infinite bus bars.

Teaching Methodology

2 hour lectures and 1 hour tutorial per week, and at least five 3-hour laboratory sessions per semester organized on a rotational basis.

Mode of course assessment: Continuous assessment and written University examinations shall contribute 30% and 70%, respectively of the total marks.

Instructional Materials/Equipment

1. Machines Lab
2. LCD projector

Course Textbooks

1. Charles I. Hubert,(2016), *Electric Machines*,Pearson International.
2. Alexander Gray (2015), *Electrical Machine Design - The Design and Specification of Direct and Alternating Current Machinery*, Scholar's Choice.
3. K. R. Sidhdhapura, D. B. Raval, (2016) DC Machines and Transformers, Vikas.

Course Journals

Reference Textbooks

1. K. R. Sidhdhapura, D. B. Raval,(2016), *A Textbook of Electrical Machines,*Vikas.
2. Ryan Godsell,(2014), *Electrical Machine Principles*, RG Kindle Publishing.
3. Mohamed Abdus Salam (2013), *Fundamentals of Electrical Machines*, Alpha Science, illustrated Ed.

Reference journals

1. Electrical Machines and Power Systems
2. Journal of Electrical and Electronics Engineering
3. Journal of Electrical Systems
4. Acta Electrotechnica

EEEQ309 Telecommunications and Electro-acoustics A 48 hrs, 1.0 units

Signal Classification and Analysis: Analogue, discrete and digital signals. Harmonic analysis of periodic signals. Signal representation in time and frequency domain. Generalized expansion in complete orthogonal sets. Interpretation of signals as vectors in signal space. Fourier series. Fourier and Laplace Transforms. Signal spectra and their properties. Rayleigh theorem.

Sampling theorem for baseband and passband signals. Energy Distribution in the Spectrum of non-periodic signals. Relationship between auto-correlation function and the power spectral density of a signal. Power spectral density of random processes. Energy spectrum and auto-correlation of a random signal. Frequency domain analysis of discrete-time signals: The Discrete Fourier Transform (DFT) and the First Fourier Transform(FFT) and their properties. The Hilbert Transform. Deterministic signals through linear systems. Analogue Modulation Schemes: Linear Modulation: Complex envelope AM, DSB, DSBSC, VSB, SSB .Angle modulation FM & PM. Demodulators for AM and FM signals. Frequency division multiplexing. Noise in analog modulation: Effects of noise in AM and FM systems. Demodulator performance in the presence of noise. Pre-emphasis and de-emphasis filtering threshold in FM system. Comparison of system performance in noise (AM & FM). Propagation of acoustic waves: Transmission of acoustic waves. Dissipation of acoustic energy in fluids, Introduction to radiation and reception of acoustic waves, Noise and speech.

Semester III

EEEQ310 Probability and Statistics 48 hrs, 1.0 units

Prerequisites

None

Purpose

The aim of this course is to enable the student to;

1. introduce students to methods of analyzing data.
2. teach the students to calculate probability using various laws of probability.
3. introduce students to various sampling methods.

Learning Outcomes

At the end of this course, the student should be able to;

1. calculate the mode, frequency, mean etc for a given data.
2. determine probability using any of the available laws of probability.
3. analyze a given set of data and determine any parameter that may be required from the data.

Course Description

Basic concepts: definition and the role of statistics; simple techniques for describing statistical data; summary statistical measures. Probability: elementary events and the sample space; compound events; conditional and joint probabilities; the multiplication law, probability trees, and sampling; the factorial, combinations, and permutations; Bayes' theorem. Random variables, expectation, and variance. Discrete probability distributions: basic concepts; the normal, the exponential, the uniform, the Gamma, the lognormal, the t, the chi, and the F distributions. The expectation and its properties. Joint probability distributions: the bivariate probability distribution; the multinormal distribution; marginal probability distributions; conditional probability distributions; independence; covariance and correlation coefficient; characteristics of sums and means of random variables; the moment generating function. Statistical sampling: the need for sampling; the process of sampling; limitations in sampling.

Sampling distributions: sampling distributions of the mean, proportion, and variance. Estimation: estimators and estimates; point and interval estimates. Hypothesis testing: basic concepts; testing the mean, proportion, and variance; selection of the test procedure. Regression analysis: linear regression using least squares; statistical inference; correlation analysis; assessment of the quality of regression; curvilinear regression. Analysis of variance: one-way classifications; two-way classifications; multiple comparisons. Quality control: the control chart; tolerance limits; acceptance sampling. Reliability analysis: basic concepts; failure-time distributions; predicting the reliability of systems; life testing and reliability assessment.

Teaching Methodology

3 hour lectures and 1 hour tutorial per week

Mode of course assessment: Continuous assessment and written University examinations shall contribute 30% and 70%, respectively of the total marks.

Instructional Materials/Equipment

1. Presentation software
2. LCD projector

Course Textbooks

1. MacClave J. T., Sincich T. L. & William M. (2016*), First Course in Statistics*, Prentice Hall.
2. Richard A. Johnson, Gouri K. Bhattacharyya, (2014)*Statistics: Principles and Methods*, Wiley.

Course Journals

Reference Textbooks

1. Jay L. Devore,(2015), *Probability and Statistics for Engineering and the Sciences*,Brooks Cole.
2. Levy P.S. & Lemeshow S. (2008), *Sampling of Populations: Methods and Applications*, Wiley.

3. Triola M. F. (2009), *Outlines and Highlights for Elementary Statistics*, Academic Internet Pub Inc.

Reference Journals

1. Electromagnetics
2. International Journal of Numerical Modelling: Electronic Networks, Devices and Fields

EEEQ311 Numerical Methods 48 hrs, 1.0 units

Prerequisites

Mathematics IIB

Purpose

The aim of this course is to enable the student to;

1. understand interpolation and numerical integration
2. understand numerical solution of ordinary differential equations

Learning Outcomes

At the end of this course, the student should be able to;

1. do numerical differentiation and integration
2. use numerical solution of ordinary differential equations in telecommunication systems

Course Description

Computer calculations: computer arithmetic; computational errors. Solution of equations in one variable: the bisection method; the fixed-point iteration; the Newton –Raphson method; error analysis; acceleration of convergence. Solution of linear systems of equations: systems of linear equations; direct methods; iterative methods. Solution of nonlinear systems of equations: Newton's method; quasi Newton methods; steepest descent techniques. Methods for approximating eigenvalues: iterative methods; transformation methods; the LR and QR algorithms. Interpolation and polynomial approximation: interpolation and the Lagrange polynomial; divided differences: Hermite interpolation; cubic spline interpolation; parametric curves. Approximation theory: discrete least squares approximation; orthogonal polynomials and least squares approximation; Chebyshev polynomials; rational function approximation;

trigonometric polynomial approximation; Fourier transforms. Numerical differentiation and integration. Initial-value problems in ordinary differential equations: elementary theory of initial-value problems; Euler's method; higher order Taylor methods; Runge-Kutta methods; Runge-Kutta-Fehlberg method; multistep methods; extrapolation methods; higher-order equations; systems of differential equations; stability of solution; stiff differential equations. Boundary-value problems in ordinary differential equations: shooting methods; finite difference methods; the Rayleigh-Ritz method. Numerical solution of partial differential equations: elliptic, parabolic, and hyperbolic differential equations.

Teaching Methodology

3 hour lectures and 1 hour tutorial per week

Mode of course assessment: Continuous assessment and written University examinations shall contribute 30% and 70%, respectively of the total marks.

Instructional Materials/Equipment

1. Presentation software
2. LCD projector

Course Textbooks

1. A. C. Faul, (2016), *A Concise Introduction to Numerical Analysis*, Chapman and Hall/CRC.
2. Richard L. Burden, J. Douglas Faires (2015), *Numerical Analysis*, Thomson Brooks/Cole.

Course Journals

Reference Textbooks

1. Kendall Atkinson (2016), *Elementary Numerical Analysis*, Wiley.
2. Chapra Canale,(2016), *Numerical Methods for Engineers*, Mc Graw Hill India.

EEEQ312 Electric Circuit Theory IIB 60 hrs, 1.25 units

Prerequisites

Electric Circuit Theory IB

Purpose

The aim of this course is to enable the student to;

1. Use differential equation to analyze circuit dynamics
2. Familiarize themselves with Fourier and Laplace transforms and apply them in solving circuits
3. Analyze the RLC circuits and their stability using the Fourier and Lapse transforms

Learning Outcomes

At the end of this course, the student should be able to;

1. Obtain circuit parameters of dynamic circuits using differential equations
2. Solve dynamic circuits using Fourier and Laplace transforms.
3. Obtain the frequency response, resonance and selectivity of RLC circuits.

Course Description

Two Port Networks: Types of networks (T, pi, L). Network parameters. Image impedance and image transfer constant. Iterative impedance and transfer function, propagation constant. Voltage, current and power ratios, insertion loss. Composite networks, interconnection. Design of attenuators and impedance matching networks. Transmission Lines: Types of Transmission lines. Field distribution. Physical model of transmission lines. Transmission line equations. Characteristic impedance. Propagation constant, attenuation and phase. Distortion less line, telegraph and telephone lines. Solution of transmission line equations. Reflection and standing waves. Impedance of a transmission line. Lossless lines. Characteristic of quarter wavelength, half wavelength lines. RF lines. Smith chart and computer techniques. Stub matching. Open circuit and short circuit terminations. Network Synthesis: Mathematics of networks synthesis. The positive real concept. Realizability conditions on network functions. Networks with ideal transformers. Realizability conditions on networks without transformers. Realization of driving

point functions. Two element kind (RC, RL, LC) networks. Realization of general driving-point functions. Approximation. Polynomials and rational functions useful in approximately. Approximation of ideal low-pass characteristics, maximally flat property. Butterworth, Bessel polynomials. Frequency transformations for high-pass and band-elimination filters

Teaching Methodology

2 hour lectures and 1 hour tutorial per week, and at least five 3-hour laboratory sessions per semester organized on a rotational basis.

Mode of course assessment: Continuous assessment and written University examinations shall contribute 30% and 70%, respectively of the total marks.

Instructional Materials/Equipment

1. Electronics Lab
2. LCD projector

Course Textbooks

1. V.K. Aatre, (2014) Network theory and filter design, New Age International.
2. A.V.Bakshi U.A.Bakshi (2008), Network Theory, Technical Publications.
3. Ernesto Estrada, Philip Knight, (2015) A First Course in Network Theory, Oxford University Press.

Course Journals

Reference Textbooks

1. G. I. Atabekov (2014), Linear network theory, Pergamon Press.
2. S.K. Sahdev (2015), Basic Electrical Engineering, Pearson.

Reference Journals

1. IEEE Transactions on Circuits and Systems
2. Open Electrical and Electronics Engineering Journal

3. International Journal of Circuit Theory and Applications

EEEQ313 Analogue Electronics B 60 hrs, 1.25 units

Prerequisites

Analogue Electronics A

Purpose

The aim of this course is to enable the student to;

1. understand the operation of operational amplifiers, oscillators and signal conditioners

Learning Outcomes

At the end of this course, the student should be able to;

1. design operational amplifiers
2. design oscillators, signal conditioners and instrumentation amplifiers
3. apply these devices in telecommunication engineering field

Course Description

Ideal operational amplifiers (opamp): addition, subtraction, differentiation, and integration using opamps. The difference amplifier. The difference amplifier and its characteristics, the ideal op-amp. Feedback arrangements, concept of virtual ground. Offset voltages and bias current, common mode rejection ratio. Frequency response and stability. Compensation techniques. Slew rate and full-power bandwidth, gain, input impedance, output importance, inverting and non-inverting configurations. Linear op-amp circuits: integration, differentiation, stability. Basic op-amp difference amplifier, instrumentation amplifier, instrumentation amplifier. Voltage to current to voltage converters. Non-linear op-amp circuits: voltage comparators, multivibrators, square-wave generators, function generators, precision rectifiers, log/antilog amplifier. Integrated circuits: IC design philosophy, special techniques for implementing analogue and digital IC circuits. Medium scale integration (MSI), Large Scale Integration (LSI), Very large Scale Integration (VLSI) manufacturing techniques and computer aided manufacturing (CAM). Fabrication of IC, computer aided design.

Teaching Methodology

2 hour lectures and 1 hour tutorial per week, and at least five 3-hour laboratory sessions per semester organized on a rotational basis.

Mode of course assessment: Continuous assessment and written University examinations shall contribute 30% and 70%, respectively of the total marks.

Instructional Materials/Equipment

1. Electronics Lab
2. LCD projector

Course Textbooks

1. Johan Huijsing,(2016), *Operational Amplifiers: Theory and Design*,Springer.
2. Jimmie J. Cathey (2002), *Schaum's outline of theory and problems of electronic devices and circuits*, McGraw-Hill, 2nd Ed.

Reference Textbooks

1. George Burbridge Clayton & Steve Winder (2003), *Operational amplifiers*, 5th Ed.
2. Robert L. Boylestad, Louis Nashelsky (2015), *Electronic devices and circuit theory*, Prentice-Hall, 11th Ed.
3. Coughlin & Driscoll,(2015), *Operational Amplifiers And Linear Integrated Circuits,*Pearson India

Reference journals

1. Solid-State Electronics
2. IEE Proceedings: Circuits, Devices and Systems
3. International Journal of Electronics
4. IEEE Transactions on Circuits and Systems
5. New Electronics

EEEQ314 Electromagnetic Fields B 48 hrs, 1.0 unit

Prerequisites

Physics B

Mathematics II B

Purpose

The aim of this course is to enable the student to;

1. distinguish vector fields from scalar fields.
2. appreciate charges and current as sources of electric and magnetic fields.
3. solve simple problems involving electric and magnetic fields penetrating boundaries of different media
4. derive Maxwell's equations from the basic laws of electricity and magnetism.

Learning Outcomes

At the end of this course, the student should be able to;

1. carry out analysis relating to electric and magnetic fields using the classical laws of electricity and magnetism.
2. acquire basic understanding of the principles of electromagnetic theory and their application to modern science and technology.

Course Description

Maxwell's equations: differential and integral forms. Plane wave propagation in free space and in a dielectric. General plane wave solutions. Polarization- parallel and perpendicular polarizations. Poynting theorem. Energy and power. Plane wave propagation in a good conductor. Skin effect. Propagation through a media interface: Normal incidence at an interface with a lossless medium, a good conductor, and a perfect conductor. The surface impedance concept. Oblique incidence at an interface Fresnel's equation, Brewster angle, total reflection, and Snell's law. Image theory. Guided wave systems: open wire lines, parallel plates, circular pipes and coaxial lines. Parallel-plate waveguide and general formulation for guided waves; propagation modes (TE, TM, and TEM).

Teaching Methodology

2 hour lectures and 1 hour tutorial per week, and at least five 3-hour laboratory sessions per semester organized on a rotational basis.

Mode of course assessment: Continuous assessment and written University examinations shall contribute 30% and 70%, respectively of the total marks.

Instructional Materials/Equipment

1. Telecommunication Lab
2. LCD projector

Course Textbooks

1. Norman Violette, (2014), Electromagnetic Compatibility, Springer.
2. Fawwaz T. Ulaby, Umberto Ravaioli, (2014) Fundamentals of Applied Electromagnetics, Pearson.
3. Sadiku, Matthew (2014), Elements of Electromagnetics, New York: Saunders.

Course Journals

Reference Textbooks

1. Bhag S. Guru, Hüseyin R. Hızıroğlu (2009) Electromagnetic field theory fundamentals, Cambridge University Press.
2. Rohit Khurana, (2016), Electromagnetic Field Theory, Vikas.
3. Joseph A. Edminister (1994), Schaum's Outline of Theory and Problems of Electromagnetics, McGraw-Hill.

Reference Journals

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EEEQ315 Electronic Circuit Design and Fabrication 60 hrs, 1.25 units

Prerequisites

Purpose

The aim of this course is to enable the student to:

1. understand the design principles of electronic circuits

2. understand the process of PCB fabrication

3. understand the process and importance of testing electronic circuits.

Learning Outcomes

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

1. design electronic circuits

2. fabricate electronic circuits on PCBs

3. test electronic circuits.

Course Description

Electronic Design Methodology: Concepts of tolerance analysis and design. Methods of tolerance design including the Monte Carlo method, Burn-In and accelerated ware. Bipolar and CMOS operational amplifier design. Bandwidth and Slew rate, short circuit protection, interval compensation band gas regulator, Digital CMOS circuit design, Dynamic circuits, Charge sharing problems, test vector generation, fault models. MOS capacitor, low and high frequency capacitances, physical models and equivalent circuits, MOS transistor; Long and short channel MOSFETS, characteristics; threshold voltage and body effect; sub threshold behaviour, device scaling, short-channel effects, CMOS process, MOSFET modelling, Gate drain and dielectric engineering, Bipolar junction transistors; Structures and high current effects; Conventional and polyemitter, BJT, BICMOS technology. Integrated circuits fabrication technology; CMOS and NMOS inverter design, aspect ratios of pull-up and pull-down transistors, switching characteristics of CMOS and NMOS inverters, Latch-up stick diagram, Design rules. Layout sub-systems design, elementary analogue building blocks, Transconductors design. Design exercise using CAD tools. Computer-Aided engineering (CAE): Description of the hardware devices and software packages used in CAE. Introduction to a simple CAD tool. CAD fundamentals and benefits. Schematics, simulation, layout, analysis tools. CAE, engineering workstations and

environments. Case studies. Hardware. Input/Output devices, plotters, printers, VDU/Printer, Secondary store. Software. Configuration, CAD/CAM integration. Introduction to the ORCAD, Circuit Maker package, Eagle Package and Prostel Software.

Teaching Methodology:

2 hour lectures and 1 hour tutorial per week, and at least five 3-hour laboratory sessions per semester organized on a rotational basis.

Instruction materials/equipment

1. Electronics Laboratories
2. Projectors

Prescribed text books

1. Nihal Kularatna (2008), Electronic Circuit Design: From Concept To Implementation, Taylor& Francis.
2. Reis Ronald (2004), Electronic Project Design and Fabrication, Prentice Hall.

References

1. R. Spencer, M. Ghausi, S. Ghausi (2002), Introduction to Electronic Circuit Design, Prentice Hall.
2. David J. Comer Donald T. Comer, & Donald T. Comer (2002), Fundamentals of Electronic Circuit Design, John Wiley &Sons.

EEEQ316 Digital Electronics 60 hrs, 1.25 units

Prerequisites

None

Purpose

The aim of this course is to enable the student to;

1. understand number systems and codes and their application
2. understand Boolean algebra and logic gates

Learning Outcomes

At the end of this course, the student should be able to;

1. use logic gates to design combinational and sequential circuits

Course Description

Number systems: types, conversion, arithmetic operations. Codes:' Binary Coded Decimal (BCD), Gray, Excess-3; alphanumeric; error detecting/correcting, encoding/decoding. Application of various codes. Boolean algebra and logic gates: basic derived gates, circuits, truth tables, logic symbols, levels, Boolean expressions, axioms and postulates of Boolean algebra. Minimisation of Boolean expressions; Venn diagrams, laws and theorems. Karnaugh maps, logic implementation. Design and synthesis of digital systems using both combinational and sequential circuits. Includes laboratory projects implemented with standard ICs. Apply concepts of number systems to perform binary arithmetic and conversions between bases. Apply Boolean algebra and K-Map to simplification of Boolean expressions, and analysis and synthesis of digital circuits. Design combinational circuits: integrated circuits (IC), adders, subtractors, comparators, encoders, decoders, multiplexers, demultiplexers, and code converters by using logic gates. Design sequential circuits: pulse generator, counters, registers, using flip-flops and logic gates. Design and test digital circuits using MSIs, EPROMs and simple CAD tools.

Teaching Methodology

2 hour lectures and 1 hour tutorial per week, and at least five 3-hour laboratory sessions per semester organized on a rotational basis.

Mode of course assessment: Continuous assessment and written University examinations shall contribute 30% and 70%, respectively of the total marks.

Instructional Materials/Equipment

1. Presentation software

2. LCD projector

Course Textbooks

1. Puri (1997), *Digital Electronics: Circuits and Systems*, Tata McGraw-Hill.
2. Roger L. Tokheim (2013), *Digital Electronics: Principles and Applications*,McGraw-Hill Education.
3. Anil Kumar Maini (2007), *Digital electronics: principles, devices and applications*, McGraw-Hill, illustrated Ed.

Course Journals

References

1. William H. Gothmann (1982), *Digital Electronics: An Introduction to Theory and Practice*, Prentice-Hall, 2nd Ed.
2. Tertulien Ndjountche (2016), *Digital Electronics*, Wiley.

EEEQ317 Telecommunications and Electro Acoustics B 48 hrs, 1.0 units

Prerequisites

None

Purpose

The aim of this course is to enable the student to;

1. understand digital coding systems and their application
2. understand measurement of loudspeaker characteristics
3. understand acoustic vibrations
4. understand the principles of loud speakers and loud speaker cabinets
5. understand calibration methods for loudspeakers

Learning Outcomes

At the end of this course, the student should be able to;

1. differentiate between the various types of digital coding techniques
2. evaluate acoustic noise

3. describe the principle of operation of digital satellite

4. analyse and design auditoria, sound studios and audio localization.

Course Description

Digital Systems: PCM, DPCM, DM, PWM, PPM, PAM. Quantization noise in PCM SNR in PCM. baseband systems. Frame synchronization, Telephone systems (TDM) Signalling systems Digital Satellite systems (TDMA) Electroacoustics; analogues and filters; Mechanical, and electrical analogues; acoustic resonators; Acoustic filters. Fundamentals of vibration: Vibration and the acoustic wave equation. Transverse and longitudinal vibrations. Vibrations of plates and membranes. Loudspeaker and microphone systems: idealized, direct-radiator loudspeaker; Typical cone speaker Acoustic doublet. Loudspeaker cabinets. Horn loudspeakers. Measurement of loudspeaker characteristics. Microphones: types, characteristics, Calibration methods. Acoustic noise and its measurement. Design and analysis of auditoria, sound studios and audio localization/spatialization.

(d) Year IV

Semester I

EEEQ401 Project Design and Fabrication (Internal Attachment)432 hrs (12 Weeks), 4.5 units

Purpose

The aim of this course is to enable the student to;

1. understand the process involved in design and development of a product.
2. understand design and fabrication of PCB

Learning Outcomes

At the end of this course, the student should be able to;

1. design and develop a product.
2. Design and fabricate PCB

Each student should conceive, design, develop and realize an electronic product. The basic elements of product design; the function ergonomics and aesthetics should be considered while conceiving and designing the product. The electronic part of the product should be an application of the analogue and digital systems covered so far. The realization of the product should include design and fabrication of PCB. Study of PCB design (single sided and double sided) may use any available software.

Semester II

EEEQ402 Linear Integrated Circuits 60 hrs, 1.25 units

Prerequisites

EEEQ313 Analogue Electronics B

Purpose

The aim of this course is to enable the student to;

1. understand special techniques for implementing analogue and digital IC circuits

2. understand the different ICs i.e MSI, LSI and VLSI

Learning Outcomes

At the end of this course, the student should be able to;

1. use manufacture techniques like computer aided manufacturing (CAM) in IC design

Course Description

Operational amplifier, ideal op-amp parameters, inverting and non-inverting amplifier, summing amplifier, integrator, differentiator, Differential amplifiers. Instrumentation amplifiers, voltage to current and current to voltage converters. Comparators, precision rectifiers, log-antilog amplifiers, oscillators – phase-shift, Wien-Bridge. Multivibrators – Astable, Monostable, Schmitt Trigger, Square and triangular waveform generator, non-ideal op-amp. Effect of finite open loop gain, bandwidth and slew rate on circuit performance. Simplified internal circuit of 741 op-amp. DC & AC analysis, gain and frequency response. Filters: Butterworth 1^{st} order Low pass, High pass, Bandpass, and Band elimination. Biquadratic filter (single op-amp with finite gain non inverting-Sallen and key) of Low pass, High pass, Band pass and Band elimination filters. Tow-Thomas filters. Filters using Antonio's gyrator. Switched capacitor Resistor: 1^{st} order, 2^{nd} order based on Tow-Thomas. Voltage Regulators; IC 723 and its applications, Current boosting, short circuit and fold back protection. Three terminal regulators, dual tracking regulators – switching regulators. PLL principle, IC 565 - analysis of lock range and capture range. Applications of PLL. Waveform generators- IC 8038; IC power amplifiers –IC 380; Comparator –IC 311; Timer IC 555, its application (Astable and Monostable).

Teaching Methodology

2 hour lectures and 1 hour tutorial per week, and at least five 3-hour laboratory sessions per semester organized on a rotational basis.

Mode of course assessment: Continuous assessment and written University examinations shall contribute 30% and 70%, respectively of the total marks.

Instructional Materials/Equipment

1. Electronics Lab
2. LCD projector

Course Textbooks

1. D. R, Choudhury,(2017) *Linear Integrated Circuits,* New Age International.
2. Salivahanan S. (2014) *Linear Integrated Circuits,*McGraw Hill Education.
3. Jan M. Rabaey (2003), *Digital Integrated Circuits: A Design Perspective*,Prentice Hall, illustrated ed.
4. A. Sudhakar,(2015), *Linear and Digital Integrated Circuits Design,*Laxmi Publications.

Course Journals

Reference Textbooks

1. R. G. Hibberd (1969), *Integrated Circuits: A Basic Course for Engineers and Technicians*, McGraw-Hill, illustrated Ed.
2. Michael M. Cirovic (1977), *Integrated circuits: a user's handbook*, Reston Pub. Co., illustrated Ed.

Reference Journals

1. Active and Passive Electronic Components
2. IEEE Transactions on Semiconductor Manufacturing
3. VLSI Design
4. SMT – Surface Mount Technology
5. Materials Science in Semiconductor Processing

EEEQ403 Power Electronics 60 hrs, 1.25 units

Prerequisites

EEEQ334 Analogue Electronics B

Purpose

The aim of this course is to enable the student to;

1. understand the working principle of various power devices
2. understand applications of the power devices in power control

Learning Outcomes

At the end of this course, the student should be able to;

1. design various converters and power control devices
2. do harmonic analysis

Course Description

Operation of single phase and polyphase half-controlled bridge circuits. Fully controlled bridge circuits. Free-wheeling diode. AC voltage control, rf interference. Forced-commutation thyristor applications - definition of forced commutation and additional stresses imposed on the thyristor. Methods of forced commutation. DC-DC conversion. Step-down and step-up of voltage by chopping. Basic DC chopper theory with voltage variation by time ratio control. Operation and analysis of simple chopper circuits. DC-AC conversion. Forced commutated inverters: series capacitor and parallel capacitor commutation, impulse commutation with circuit examples. Use of feedback diodes. Polyphase inverter circuits. Introduction to GTO applications. Selection and cost of passive and magnetic components for high current applications. High voltage DC transmission converters. Power transistor applications: DC-DC and DC-AC conversion using power transistors. Power transistor drive requirements, power dissipation and protection.

Teaching Methodology

2 hour lectures and 1 hour tutorial per week, and at least five 3-hour laboratory sessions per semester organized on a rotational basis.

Mode of course assessment: Continuous assessment and written University examinations shall contribute 30% and 70%, respectively of the total marks.

Instructional Materials/Equipment

1. Electronics Lab
2. LCD projector

Course Textbooks

1. D. Nelson Bolívar (2017), *Fundamentals of Power Electronics*, Arcler Press LLC.
2. Muhammad H. Rashid, (2014), *Power Electronics: Devices, Circuits, and Applications*, Pearson.
3.

Course Journals

Reference Textbooks

1. Tudor Volkov,(2016) *Fundamentals of Power Electronics,* Scitus Academics LLC.
2. Ned Mohan, Tore M. Undeland, William P. Robbins (2007), *Power electronics: converters, applications, and design*, Wiley.

Reference Journals

1. Advances in Power Electronics
2. Power Electronics Technology
3. EPE: European Power Electronics and Drives Journal
4. IEEE Transactions on Power Electronics
5. International Journal of Power Management Electronics

EEEQ404 Transmission Lines and Waveguides 60 hrs, 1.25 units

EEEQ339 Electromagnetic Fields

Purpose

The aim of this course is to enable the student to;

1. understand transmission lines; their design and implementation; their range of operation frequency and application areas.

Learning Outcomes

At the end of this course, the student should be able to;

1. apply his/her acquired knowledge and skills gained through laboratory practices and industrial attachment to design and construct standard transmission lines.
2. select suitable transmission lines for different telecommunication engineering tasks.

Course Description

Transmission – line theory: analysis of uniform transmission line made up of a cascade of incremental sections. Expressions for the attenuation constant and phase constant in terms of line constants. Waveform distortions. Reflection on an unmatched line. Input and transfer impedance of a line. Open and short-circuit lines. Transmission lines at high frequencies: Line of zero dissipation. Standing wave ratio. Input impedance for various terminations. Power and impedance measurements on the line. Quarter wave and half wave lines. Impedance matching, single-stub matching with Smith chart, double-stub impedance matching. Guided waves: Waves between parallel planes, TE and TM waves. Characteristics of TE and TM waves. TEM waves. Velocities of propagation. Waveguides: Rectangular guides. TE waves and TM waves in waveguides. Methods of excitation. Circular guides: TM and TE waves. Wave impedances. Waveguide discontinuities.

Teaching Methodology

2 hour lectures and 1 hour tutorial per week, and at least five 3-hour laboratory sessions per semester organized on a rotational basis.

Mode of course assessment: Continuous assessment and written University examinations shall contribute 30% and 70%, respectively of the total marks.

Instructional Materials/Equipment

1. Communication Lab
2. LCD projector

Course Textbooks

1. R. S. Rao (2016), *Microwave Engineering*,Prentice-Hall of India Pvt.Lt.
2. U. A. Bakshi, A. V. Bakshi (2014), *Transmission Lines and Waveguides*, Technical Publications.
3. Edward F. Kuester, (2017) *Theory of Waveguides and Transmission Lines*, CRC Press.**Course Journals**

Reference Textbooks

1. Nathan Ida,(2015), Engineering Electromagnetics, Springer.
2. Simon Ramo & John R. Whinnery (2006), *Fields and Waves in Communication Electronics*, McGraw, 2nd Ed.
3. Richard L. Liboff & G. Conrad Dalman (1985), *Transmission lines, waveguides, and Smith charts*, Macmillan

Reference journals

EEEQ405 Digital Signal Processing 60 hrs, 1.25 units

Prerequisites

EEEQ334 Analogue Electronics B

Purpose

The aim of this course is to enable the student to;

1. understand discrete systems and Fourier transforms
2. understand Z-transforms
3. understand design of IIR and FIR filters

Learning Outcomes

At the end of this course, the student should be able to;

1. use Fourier and Z-transforms in the design of FIR and IIR filters
2. design IIR and FIR filters

Course Description

DSP: Its benefits. Key DSP operations. Applications in audio, telecommunications and biomedical. Sampling continuous time signals. Anti-aliasing filters. Quantization effects in the in the computation of DFT. Digital filter structures. Block diagram and signal flow graph representation. Basic FIR and IIR structures. State-space structures. Digital filter design. FIR filter design based on window methods . (Truncated Fourier series, Bartlett, Blackman, Hamming, Hanning, Kaiser) and frequency sampling approach. Adaptive digital filter>Basic concepts and applications. Quantization and round off effects in digital filters. Multirate DSP. Design of decimator and interpolator. Digital signal processors: Architecture for signal processing. General purpose processors, special DSP hardwares. Application and design studies. Evaluation boards for real time signal processing. Detection of foetal heart beats. Equalization of digital audio signals. Spectral analysis of audio signals. Transmultiplexers, multitone transmission of digital data.

Teaching Methodology

2 hour lectures and 1 hour tutorial per week, and at least five 3-hour laboratory sessions per semester organized on a rotational basis.

Mode of course assessment: Continuous assessment and written University examinations shall contribute 30% and 70%, respectively of the total marks.

Instructional Materials/Equipment

1. Presentation software
2. LCD projector
3. Laboratory work

Course Textbooks

1. John G. Proakis and Vinay K. lngle (2016), *Digital Signal Processing using Matlab*,International Thomson.

2. Jose Maria Giron-Sierra (2016) Digital Signal Processing with Matlab Examples, Springer.
3. Monson H. Hayes (2011), *Schaum's Outline of Theory and Problems of Digital Signal Processing*, McGraw-Hill.

Course Journals

Reference Textbooks

1. K. Raja Rajeswari,(2014) *Digital Signal Processing,* I K International Publishing House.
2. Edmund Lai (2003), *Practical Digital Signal Processing for Engineers and Technicians*, Newnes, 1st Ed.
3. Andreas Antoniou (2006), *Digital Signal Processing Signals Systems and Filters*, McGraw.

Reference Journals

1. IEEE Transactions on Acoustics, Speech & Signal Processing
2. Eurasip Journal on Applied Signal Processing
3. IEEE Transactions on Circuits and Systems Part II: Analog and Digital Signal Processing
4. EURASIP Journal on Advances in Signal Processing
5. International Journal of Signal Processing

EEEQ406 Control Systems Engineering A 60 hrs, 1.25 units

EEEQ209 Mathematics II B

Purpose

The aim of this course is to enable the students to;

1. perform block diagram analysis of feedback control systems
2. understand design of controllers using the root locus
3. understand the design of controllers using Nyquist frequency techniques

Learning Outcomes

At the end of this course, the student should be able to;

1. differentiate between the various control actions and their application
2. select an appropriate control action for a specific design

3. Design PI,PD and PID controllers

Course Description

Dynamic models and dynamic responses: Models of dynamic system in different equation form. Linearization, amplitude and time scaling. Transfer function representation of models. Time-domain effects such as rise time, overshoot, setting time. Feedback control system concepts and stability: Essential principles of feedbacks. Direct block diagram modeling of feedback systems. Effect of parameter sensitivity and disturbance response, steady state error in feedback system, transient response verses steady state errors. Stability, Routh-Hurwitz stability criterion, relative stability of feedback. Determination of root location in S-plane. Root locus method: Root loci, plotting of root loci. System design using root loci. Phase lead and lag compensation using rood loci, computer aided plotting of root loci Frequency – response methods: Frequency response functions, Bode plots, M & N N-circles. Lead-lag compensation. Frequency response performance specifications. Nyquist stability criterion, Nyquist diagram and stability, gain and phase margins, closed-loop frequency response, Stability of control system with time delays. Examples of |Frequency response design and analysis using a computer-aided control engineering tool such as MATLAB'S Control, System Toolbox.

Teaching Methodology

2 hour lecture and 1 hour tutorial per week and at least three 3-hour laboratory session per semester organized on a rotational basis.

Mode of course assessment: Continuous assessment and written University examinations shall contribute 30% and 70%, respectively of the total marks.

Instructional Materials/Equipment

1. Control Engineering laboratory
2. LCD projector

Course Textbooks

1. Norman S. Nise,(2015) *Control Systems Engineering,* Wiley.
2. Distefano J. J, Stubberud A.R.,& Williams I.J (2013), *Feedback and Control Systems,; Theory and Problems (Schaum's Outline Seties)*, McGraw-Hill, 2nd Ed.
3. Ogata K. (2016), *Modern Control Engineering*, Prentice Hall.

Course Journals

Reference Textbooks

1. Kuo, B.C, &Farid G. (2017), Automatic Control Systems, Wiley.
2. Gene F., (2014), *Feedback Control of Dynamic Systems*, Prentice Hall.

Reference Journals

1. Automatic control and computer science
2. Electrika: Journal of Electrical Engineering
3. Russian Electrical Engineering
4. Computing and Control Engineering
5. Acta Electrotechnica

EEEQ407 Microprocessor Systems A 60 hrs, 1.25 units

Prerequisites

Electronic Circuit Design and Fabrication

Purpose

The aim of this course is to enable the students to;

1. understand the fundamentals of microprocessors
2. understand the concepts of interior elements of a microprocessor , including data transfer and storage
3. know how to design and implement software systems

Learning Outcomes

At the end of this course, the student should be able to;

1. Describe the internal structure of a microprocessor

2. know the difference between microprocessors and micro-controllers
3. Design systems requiring microprocessor controllers

Course Description

Introduction to Microprocessors**:** Evolution of microprocessors, Register structure, ALU, Bus organization, timing and control. Microprocessor architecture: the ideal microprocessor, practical limitations, the data bus, address bus, and control bus, central processing unit architecture. Internal registers. The Arithmetic Logic Unit. Instruction word flow. Data word flow. State transmission diagram. Microprocessor instruction set. Addressing modes. Status registers. The binary code. Hexadecimal code. Flow charts. Opcodes. Fetch machine cycle. WRITE and READ machine cycle. Interrupt, acknowledge. Timing diagrams. Address allocation techniques. Address decoding techniques. Memory organization and memory management. Assembler, complier, loader, monitor, and other software aids. Assembly language. Programming with a typical microprocessor. Interfacing techniques: interfacing the decoder, static RAM with programmable Input/Output ports, ROM, ERROM with Input/Output transfers. Device-initiated interrupt Input/Output transfer. Direct memory access. Applications: microprocessor selection. Design methodology. Simple examples of applications. Use of development tools in the design and implementation of microprocessor-based systems. Design assembly language programs involving I/O devices. System bus structure, and timing and activities of bus cycles of the Z80 microprocessor.

Teaching Methodology

2 hour lecture and 1 hour tutorial per week and at least three 3-hour laboratory session per semester organized on a rotational basis.

Mode of course assessment: Continuous assessment and written University examinations shall contribute 30% and 70%, respectively of the total marks.

Instructional Materials/Equipment

1. Digital Electronics Laboratory
2. LCD projector

Course Textbooks

1. M.H. Hassan., (2015), Microprocessors and Microcomputers, Prentice Hall.
2. Crisp J. (2004), Introduction to Microprocessors and Microcontrollers, Amsterdam, Boston, Elsevier/Newnes, 2nd Ed.

Course Journals

Reference Textbooks

1. Khambata, Adi J, (1986), Microprocessors/Microcomputers: architecture, software and Systems, Wile, New York.
2. Ramesh S.G., (2014), Microprocessor Architecture, Programming, and Application with 8085, Prentice Hall.

Reference Journals

1. IEEE Micro magazine
2. Microprocessors
3. Microprocessors and Microsystems
4. Microprocessors and Microprogramming

EEEQ408 Law for Engineers 48 hrs, 1.0 units

Prerequisites

None

Purpose

The aim of this course is to enable the students to;

1. understand the Kenyan legal system
2. understand the law of contract and tort in relation to engineering

Learning Outcomes

At the end of this course, the student should be able to;

1. advice accordingly in relation to Kenyan law with different matters in engineering
2. Negotiate engineering contracts..

3. Describe the obligations of the principal and the agent.
4. Know the implications of negligence in engineering works.

Course Description

The nature and sources of law. An outline of the law of tort. The Factories Act (Cap 233.514) – main provisions as to health, safety and welfare; offences, penalties and legal proceedings. Trade Unions Act (Act (Cap. 233) – legal status of Trade Unions, registration, Figures and liabilities. Trade Disputes Act (Cap. 234) – with particular reference to the jurisdiction of the Industrial Court and the protection of essential services, life and property.

Teaching Methodology

3 hour lecture and 1 hour tutorial per week.

Mode of course assessment: Continuous assessment and written University examinations shall contribute 30% and 70%, respectively of the total marks.

Instructional Materials/Equipment

1. Presentation software
2. LCD projector

Course Textbooks

1. Jackson, T. (1970), *The Law of Kenya; An Introduction*, East African Literature Bureau

Course Journals

Reference Textbooks

1. *Laws of Kenya*, Government Printer.
2. Jackson, T., (1986*), The Law of Kenya, An Introduction, Cases and Statutes*, Kenya Literature Bureau.

Reference journals

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EEEQ409 Induction Machines 48 hrs, 1.0 units

Prerequisites: EEE 341: Electric Circuit theory IIA.

Purpose

The aim of this course is to enable the student to:

1. Understand three phase induction machines.
2. Understand single phase induction machines.
3. Understand universal motors.

Learning Outcomes

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

1. Explain three phase induction machines construction, operation and characteristics.
2. Explain speed control of three phase induction machines.
3. Explain the production of rotating magnetic field in single phase induction machines.
4. Explain working of universal motors.
5. Solve problems on induction machines.

Course Description

Three phase induction machines: construction, rotating magnetic field, equivalent circuits. Wound rotor and squirrel cage rotors, parameter determination. Analysis of operation. Starting current and its effect on supply voltage and plant equipment, starting methods. Speed/torque curves, circle diagrams, speed control (traditional methods), rating, heating losses and efficiency. Speed/torque/load requirements. Applications of induction motors. Breaking and overload protection. Single phase machines - single phase induction motors, construction. Analysis of production of rotating magnetic fields. Single phase machine windings. Universal motors. Load power/speed requirements for fans, pumps, lifts etc.

Teaching Methodology: 2 hour lecture,1 hour tutorial per week and 1 hour laboratory session.

Instruction materials/equipment

1. Electrical Machines Laboratory.

2. Projector.

Prescribed text books

1. Ryan Godsell,(2014) *Electrical Machine Principles,* RG Kindle Publishing.
2. Rajendra Prasad, (2014) *Electrical Machines,* PHI Learning.
3. D. P. Kothari, I. J. Nagrath (2004), Electrical Machines, 3rd Edition, McGraw-Hill Co.

References

1. K.R. Siddhapura, D.B. Raval, (2016), A Textbook of Electrical Machines, Vikas.
2. Tarlok Singh,(2015), Electrical Machines II, Technical Publications Pune.

Semester III

EEE410 Embedded Systems **60 hrs, 1.25 units**

Prerequisites

EEEQ471 Microprocessor Systems A

Purpose

The aim of this course is to enable the student to;

1. understand the scientific principles and concepts behind embedded systems
2. understand the basics of embedded system application concepts such as signal processing and feedback control

Learning Outcomes

At the end of this course, the student should be able to;

1. have obtained hands-on experience in programming embedded systems
2. discuss and communicate intelligently about embedded processor architecture and programming

Course Description

History of microcomputers, application of embedded controllers, Overview of 8051, 8096, 6811, 6812. 6812 architecture, 68HC12 Hardware system, modes of operation, hardware pin

assignments, 68HC12 sub system. Programming model, assembly language, instruction execution cycle, Instruction set, addressing modes, advanced assembly programming. Interrupts: general interrupts, concepts of ISR, Writing an ISR for 68HC812, advanced interrupt topics. Clock module – background theory, clock module, clock divider chain, 68HC12 timer module, components of the timer module. The Real Time Interrupt (RTI). Programming Input Capture, Output Compare and the Pulse Accumulator Features of the TIM.68HC12 memory system, 68HC12 ADC (ATD), 68HC12 Communication System. Introduction to microprocessors and embedded RISC processors, Architecture of the MPC 860 processor and power PC core. Instruction set. Programming model. MMU, instruction and data cache, memory controller, communication processors module and serial interface, serial management controller and serial communication controller. UART, HDLC and ETHERNET protocol, SDMA channels and IDMA emulation. Power control external bus interface. System development and debugging. Real time system concepts. Kernel structure, Task management. Intertask communication and synchronization, memory management. 8096 processor architecture. High speed registers, serial output ports, programmable timers, PW registers. Assembly language programming, hardware interfacing,memory. Architecture of 68C11. Instruction set, programming.

Teaching Methodology

2 hour lectures and 1 hour tutorial per week, and at least five 3-hour laboratory sessions per semester organized on a rotational basis.

Mode of course assessment: Continuous assessment and written University examinations shall contribute 30% and 70%, respectively of the total marks.

Instructional Materials/Equipment

1. Computer Lab
2. LCD projector

Course Textbooks

1. Peter Marwedel,(2017) *Embedded System Design,* Springer.
2. Tammy Noergaard (2012), *Embedded Systems Architecture: A Comprehensive Guide for Engineers and Programmers*,Newnes, illustrated ed.
3. A. K. Ganguly (2014), *Embedded Systems: Design, Programming and Applications*, Alpha Science Intl Ltd.

Course Journals

Reference Textbooks

1. Jason D. Bakos,(2016), *Embedded Systems*, Morgan Kaufmann.
2. Edward A. L., Sanjit A. S. (2016), *Introduction to Embedded Systems*, The MIT Press.**Reference Journals**
1. EURASIP Journal on Embedded Systems
2. IEEE Micro Magazine

EEEQ411 Sensors and Micro-Electro-Mechanical Systems 60 hrs, 1.25 units

Prerequisites: EEEQ 471: Microprocessors A

Purpose

The aim of this course is to enable the student to:

1. understand the principles of operation of different types of sensors, transducers and actuators

2. understand principles of data processing, transmission and storage

3. understand the development of application programs for industrial processes.

Learning Outcomes

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

1. explain different types of sensors, transducers and actuators for industrial purposes

2. explain the various displays in processing systems

3. develop application programs for industrial process automation.

Course Description

History of MEMS, market for MEMS, overview of MEMS processes, properties of silicon, a sample of MEM process. Basics of micro-technology - definition and technology, a sample process, lithography and etching. MEMS biosensors- bio flow sensors, MEMS images. Introduction to MEMS design software. Micro machining- subtractive processes (wet and dry etching) additive processes (evaporation, sputtering, epitaxial growth). Fundamental devices and processes- basic mechanics and electrostatics for MEMS, parallel plate actuators, pull in point, comb drives, electrostatic actuators, MEMS foundries, Cronos MUMPS (multi user MEMS process)- JDS uniphase MUMPS processing sequence and design rules. MUMPS and SUMMIT-design rules, applications, micro hinges and deployment actuators. CMOS MEMS- CMOS foundry process, integrated IC/MEMS, MEMS post processing, applications. Clean-room lab techniques- clean rooms, grown long procedures, safety, fire toxicity, acids and basis, photolithography. Thermo transducers- bimorphs, 'heat actuators', cilia arrays. Micro-Opto-Electro-Mechanical systems actuator, optical switches, other micro optical devices. Piezo resistivity, Scanning probe microscopy- scanning tunneling microscope (STM), atomic force microscope (AFM). Wireless MEMS- mechanical and electrical resonators, Q factor, switches, filters. Power for MEMS- thin film batteries, micro fuel cells, energy fields. MEMS packaging and assembly; micro assembly- serial, parallel, deterministic and stochastic, microgrippers, Hexcel process, packaging techniques. The future of MEMS- bio MEMS, neural implants, gene chips, diagnostic chips, MEMS in space, Mechanical computers, invisible and ubiquitous computing.

Teaching Methodology: 2 hour lecture and 1 hour tutorial per week and at least three 3-hour laboratory sessions per semester organized on a rotational basis

Instruction materials/equipment

1. Computer Laboratory
2. Control Engineering Laboratory
3. Projector

Prescribed text books

1. Jon Stenerson (2002), Industrial Automation and Process Control, Prentice Hall, ISBN: 0130330302

2. Ghodrat Kalani (2002), Industrial Process Control: Advances and Applications, Gulf Professional Publishing, ISBN: 0750674466

References

1. S. K. Singh (2009), Process Control: Concepts, Dynamics and Applications, Prentice Hall, ISBN: 812033678X

2. E. Parr (1999), Industrial Control Handbook, 3rd Ed., Industrial Press, ISBN: 0831130857

3. Journal of Process Control

EEEQ412 Internet Databases and Programming 48 hrs, 1.0 units

Prerequisites

EEEQ337 Programming and Simulation

Purpose

The aim of this course is to enable the student to;

1. understand evolution of telephony
2. understand structure of basic transmission systems and network topologies

Learning Outcomes

At the end of this course, the student should be able to;

1. apply knowledge of telephony in telecommunication systems

Course Description

In addition to thinking as the Web as a 'pipe' to link databases, this course also considers the Web itself as a vast data resource and information grid. In the first context, this module teaches the principles of linking individual databases to the Internet and linking these to each other via the Internet. In the latter context, this module will also focus on how we can mine the Internet for data and hence information. Internet Databases provides a practical introduction to the technologies needed to create and maintain program databases, to exchange data across the

Internet and to mine large data-spaces for information. This module provides both the theoretical basis and a practical introduction to the programming skills and knowledge needed to create, integrate and maintain distributed database systems over local networks and the Internet, to link them together over the Internet and to extract data and information from structured, semi-structured and unstructured data sources. Upon completing this module, a student is expected to be able to: Describe the facilities and features of database management systems; Develop different database models from informal descriptions; Implement, manipulate and query relational databases applications; Use software that adheres to the relevant W3C specifications and standards such as XML to exchange structured and semi-structured data over the Internet and to access and integrate databases; Understand how database applications such as data warehouses, geo-data services and directory services can function. Introduction to Internet TCP/IP overview. Web server. Web page development using basic HTML scripts. Introduction to JAVA programming> object oriented programming concepts, java virtual machine, security, java compilers, java applets, web browsers. Declaration of constants, variables, and data types. Applet programming concepts; Building applet code, creating executable code for Applet. Adding applet to HTML file, GUI programming with JAVA AWT class. Simple programming for creating animation with JAVA. Programming for displaying image files. Managing input /output files using JAVA I/O class. Simple programs for reading and writing files. Exception handling.

Teaching Methodology: hour lectures and 1 hour tutorial per week, and at least five 3-hour laboratory sessions per semester organized on a rotational basis.

Mode of course assessment: Continuous assessment and written University examinations shall contribute 30% and 70%, respectively of the total marks.

Instructional Materials/Equipment

1. Computer Lab
2. LCD projector

Course Textbooks

1. Chris Bates (2002), *Web Programming: Building Internet Applications,* John Wiley and Sons, 2nd edition.
2. Michael D. Thomas, Pratik R. Patel and Alan D. Hudson (1996), *Java Programming for the Internet: A Guide to Creating Dynamic, Interactive Internet Applications*, Ventana, illustrated ed.

Course Journals

Reference Textbooks

1. Addison-Wesley (2000), *Internet Applications Programming*, Addison-Wesley Longman, 1nd Ed.
2. Lijun Lin (1999)*, Internet Server Application Programming Interface (ISAPI) and Data Publishing Through the World Wide Web*, East Tennessee State University.

Reference Journals

1. Computerworld
2. Journal of Computer Science

EEEQ413 Synchronous and Special Machines 48 hrs, 1.0 units

Prerequisites: EEE 341: Electric Circuit theory IIA.

Purpose

The aim of this course is to enable the student to:

1. Understand construction of synchronous machines.
2. Understand operation of synchronous machines on the infinite bus bars.
3. Understand synchronous machine design.

Learning Outcomes

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

1. Explain construction and properties of salient and non-salient rotors.
2. Explain the parallel operation of synchronous machines.

3. Explain the cooling and ratings of the machines.
4. Solve problems on synchronous machines.

Course Description

Synchronous machines - construction. Salient pole and non-salient pole rotors, equivalent circuits, alternator parameter determination, phase diagrams, armature reaction. Regulation, power/angle diagrams and equations. Operation on infinite bus-bars, V and O curves. Parallel operation, saturation. Synchronous motor starting and use for power factor correction. Synchronous machine rating, heating losses and efficiency. Rotor windings and rotor m.m.f. distortion. Stator and rotor windings. Electrical machine design - transformer design, output equation. Specific iron and copper losses. Insulation. Types of windings and connections. Cooling and ratings. Iron core dimensions. Rotating machine design - output equation, specific copper and iron losses, power/weight ratio, salient pole and cylindrical rotor, air gap flux distribution and saturation, slots, armature overhangs. Types of windings e.m.f. equation and winding coefficients. Insulation, heating, ventilation and ratings.

Teaching Methodology: 2 hour lecture,1 hour tutorial per week and 1 hour laboratory session.

Instruction materials/equipment

1. Electrical Machines Laboratory.
2. Projector.

Prescribed text books

1. Shaahin Filizadeh, (2017), *Electric Machines and Drives: Principles, Control, Modeling, and Simulation*, CRC Press.
2. T.A. Lipo (2017), Analysis of Synchronous Machines, CRC Press.

References

1. S.K. Rhatfacharya (2014), Electrical Machines, McGraw-Hill Co.
2. Tarlok Singh,(2015), Electrical Machines II, Technical Publications Pune.

EEEQ414 Control Systems Engineering B 60 hrs, 1.25 units

Prerequisites

EEEQ461 Control Systems Engineering A

Purpose

The aim of this course is to enable the students to;

1. perform block diagram analysis of feedback control systems
2. understand design of controllers using the root locus
3. understand the design of controllers using Nyquist frequency techniques

Learning Outcomes

At the end of this course, the student should be able to;

1. differentiate between the various control actions and their application
2. select an appropriate control action for a specific design
3. Design PI,PD and PID controllers

Course Description

Compensation of feedback control systems: Approaches to compensation, dynamic compensation using Proportional (P) and Integral (I), Proportional and Differential (D), and Proportional Integral and Differential compensation (PID) controllers; dynamic compensation and system simulation using operational amplifiers. Cascade compensation networks, system simulation using amplifiers. Cascade compensation networks, system compensation using phase-lead lag networks on the Bode.

Teaching Methodology

2 hour lecture and 1 hour tutorial per week and at least three 3-hour laboratory session per semester organized on a rotational basis.

Mode of course assessment: Continuous assessment and written University examinations shall contribute 30% and 70%, respectively of the total marks.

Instructional Materials/Equipment

1. Control Engineering laboratory
2. LCD projector

Course Textbooks

1. Norman S. Nise, (2015) Control Systems Engineering, Wiley.
2. Distefano J. J, Stubberud A.R.,& Williams I.J (2013), Feedback and Control Systems; Theory and Problems (Schaum's Outline Seties), McGraw-Hill.
3. Ogata K. (2016), Modern Control Engineering, Prentice Hall.

Course Journals

Reference Textbooks

1. Kuo, B.C, &Farid G. (2017), Automatic Control Systems, Wiley.
2. Gene F., (2014), Feedback Control of Dynamic Systems, Prentice Hall.

Reference Journals

1. Automatic control and computer science
2. Electrika: Journal of Electrical Engineering
3. Russian Electrical Engineering
4. Computing and Control Engineering
5. Acta Electrotechnica

EEEQ415 Robotics and Cybernetics 60 hrs, 1.25 units

Prerequisites

Programming in C/C++/Assembly Language

Purpose

The aim of this course is to enable the students to;

1. View robotics as application of control systems engineering
2. Comprehend the history of robotics
3. Comprehend the components of a robot and their roles
4. Design a robot for a given task and task environment
5. Program a robot

Learning Outcomes

At the end of this course, the student should be able to;

1. View robotics as application of control systems engineering
2. Comprehend the history of robotics
3. Comprehend the components of a robot and their roles
4. Design a robot for a given task and task environment
5. Program a robot

Course description

Automation and robotics - robot anatomy, work volume, drive systems, control system and dynamic performance precision of movement, end effects, sensors, work cell control and programming. Control system concept and models, controllers, control system analysis, activation and feedback components, position sensor, velocity sensors. Manipulator, kinematics, transformations, robot arm kinematics and dynamics, end effectors. Sensors in robotics, tactile sensors, proximity and range sensors, sensor based systems, uses of sensors in robotics. Introduction, sensing and digitizing functions in machine vision image processing and analysis, training and vision systems. Languages, a robot program as a path in science, motion interpolation, wait, signal and delay commands, branching, limitation. Introduction, goals, techniques, AI and robotics, machine. Implementation, safety, training, maintenance and quality. Simulations.

Teaching Methodology

3 hours lectures and 1 hour tutorial per week, and at least five 3-hour lab sessions per semester organized on a rotational basis.

Mode of Course Assessment

Continuous assessment and written university examinations shall contribute 40% and 60% respectively of the total marks.

Instructional Materials/Equipment

1. Automation and Control Engineering Lab
2. LCD Projector

Course Textbooks

1. Kenneth F., Millian Q.(2016) *Robotics: The Beginner's Guide to Robotic Building, Technology, Mechanics, and Processes,* Kenneth Fraser.
2. Roland S., I. R. Nourbakhsh, Davide S. (2011) *Introduction to Autonomous Mobile Robots*, MIT Press.
3. David Cook,(2015) *Robot Building for Beginners*, Apress.

Course Journals

1. Journal of Intelligent & Robotic Systems
2. International Journal of Social Robotics

Reference Textbooks

John J. Craig,(2017) Introduction to Robotics: Mechanics and Control, Prentice Hall.

Reference Journals

IEEE Transactions on Robotics

EEEQ416 Microprocessor Systems B 60 hrs, 1.25 units

Prerequisites

EEEQ471 Microprocessor Systems A

Purpose

1. understand the fundamentals of microprocessors
2. understand the concepts of interior elements of a microprocessor , including data transfer and storage
3. know how to design and implement software systems

Learning Outcomes

At the end of this course, the student should be able to;

1. Describe the internal structure of a microprocessor
2. know the difference between microprocessors and micro-controllers
3. Design systems requiring microprocessor controllers

Course Description

Architecture of a 16-bit microprocessor**: i**nternal organization of 8086, signal descriptions, physical memory organization, BIU, EU, minimum mode 8086 system and timings, maximum mode 8086 system and timing. Assembly Language Programming: addressing modes, instruction set, assembler directives and operators, data movement instructions, arithmetic and logic instructions, program control instructions, recursive procedures. Special architectural features and related programming: stack structure, interrupts and interrupt service routine, interrupt programming, macros, timings and delays. Basic peripherals and their interfacing: memory interfacing, interfacing I/O ports, programmable peripheral interface (8255), interfacing A/D and D/A converters. Special purpose programmable peripheral devices and their interfacing: Programmable Interval Timer (8253/8254), Programmable Interrupt Controller (8259), Keyboard/Display Controller (8279), Programmable Communication Interface (8251), DMA Controller (8237/8257). Microprocessor Applications: Interfacing scanned multiplexed displays and Liquid crystal displays, Interfacing matrix keyboard, Stepper motor interfacing, Case studies of microprocessor based systems, Standards for bus architecture and ports. Bus structure, and timing and activities of bus cycles of 8086 microprocessor.

Teaching Methodology

2 hour lecture and 1 hour tutorial per week and at least three 3-hour laboratory session per semester organized on a rotational basis.

Mode of course assessment:

Continuous assessment and written University examinations shall contribute 30% and 70%, respectively of the total marks.

Instructional Materials/Equipment

1. Digital Electronics Laboratory
2. LCD projector

Course Textbooks

1. M.H. Hassan., (2015), Microprocessors and Microcomputers, Prentice Hall.
2. Crisp J. (2004), Introduction to Microprocessors and Microcontrollers, Amsterdam, Boston, Elsevier/Newnes.

Course Journals

Reference Textbooks

1. Khambata, Adi J, (1986), Microprocessors/Microcomputers: architecture, software and Systems, Wile, New York.
2. Ramesh S.G., (2014), Microprocessor Architecture, Programming, and Application with 8085, Prentice Hall.

Reference Journals

1. IEEE Micro magazine
2. Microprocessors
3. Microprocessors and Microsystems
4. Microprocessors and Microprogramming

EEEQ417 Engineering Management 48 hrs, 1.0 units

Prerequisites

None

Purpose

The aim of this course is to enable the student to;

1. understand the role of project management and the Project Cycle and the importance to project management of the project appraisal, planning and determining the feasibility of the project prior to implementation.
2. understand the phases of the project cycle
3. know the various types of feasibilities that a project should be appraised for

Learning Outcomes

At the end of this course, the student should be able to;

1. differentiate various project management techniques
2. apply the concepts of compounding and discounting to telecom projects and investment
3. apply to both cost-benefit analysis and least cost analysis to the Country Team Project and to telecom projects in general.

Course Description

Basic concepts in management: the concept of managing; the management process – planning;, organizing, leading, and controlling; management levels and skills; the evolution of management theory – historical perspectives in management. Emerging concepts in management: the role of organisational and natural environments in management; social responsibility and ethics; the impact of globalisation in management; small business, introductory concepts in entrepreneurship, and the reinventing of organisations; organisational culture; quality in management – the concept of Total Quality Management (TQM). Planning: the process of decision making; organisational planning and strategic management; strategy implementation. Organising: organisational design and organisational structure – types of organisational structures and their design; power and authority in management – patterns and distribution; human resource management; managing organisational change and innovation – planned change and organisational development. Leading: motivation – theories and contemporary views; leadership – approaches and characteristics; teamwork – types and characteristics of teams; communication and negotiation – communication in organisations. Controlling: effective control – concepts in control , control systems, financial and budgetary controls, budgeting; Operations management – operations systems, design of operations systems, operational planning and control; information systems – information and control, management information systems. Engineering project planning and control techniques; the bar chart; critical path method (CPM); project evaluation and review techniques (PERT); line of balance (LOB). Resources scheduling. Site management: work study techniques; labour relations; safety. Management of human resources.

Teaching Methodology

3 hour lectures and 1 hour tutorial per week

Mode of course assessment:

Continuous assessment and written University examinations shall contribute 30% and 70%, respectively of the total marks.

Instructional Materials/Equipment

1. Presentation software
2. LCD projector

Course Textbooks

1. Turner, J. R. and simister, S. J. (2016), *Gower Hand book of project management*, Aldershot: Gower.
2. Harold Kerzner (2017), *Project management Systems Approach to Planning, Scheduling, and Controlling*, Wiley, 8th Ed

Course Journals

Reference Textbooks

1. Alex Silver,(2016), *Project management*, CreateSpace Independent Publishing Platform.
2. Harrison F. L. (2017), *Advanced project management*, Wiley.

Reference Journals

(e) Year V

Semester I

EEEQ501 Industrial Attachment 432 hrs (12 Weeks), 4.5 units

This is session to be taken during practical attachment in industry. The student shall be required to perform all the duties of an engineering trainee. This course shall be examined by field assessment and a report.

Semester II

7.5.2.1 Compulsory Courses

EEEQ502 Digital Communication 60 hrs, 1.25 units

Prerequisites

Analogue Electronics A

Purpose

The aim of this course is to enable the student to;

1. understand the operation of A/D converters
2. appreciate the importance of wave shaping in digital communications
3. know the characteristics of various digital modulations schemes
4. understand the effects of noise in digital communications

Learning Outcomes

At the end of this course, the student should be able to;

1. describe the operation of A/D converters
2. Calculate bandwidth requirements in digital communications
3. Compute data transmission rates in the presence of noise

Course Description

Introduction to digital communication systems, information and channel capacity, entropy, discrete and continuous channels, Fano and Huffman's coding. Baseband data transmission systems, error probability, ISI, pulse shaping, matched filters, M-ary signalling schemes, equalization. Symbol synchronization. Digital modulation schemes, ASK, PSK, FSK and QAM systems, probability of error in digital modulation schemes, continuous phase carrier modulation, Modems, digital transmission, fading on multipath channels, performance comparison of various digital modulation schemes. Error control coding, Hamming distance, linear block codes, cyclic codes, convolution codes. Code generation and detection methods, Viterbi coding and decoding practical applications of coding. Waveform coding. Adaptive delta-modulation, speech coding, linear predictive coding, sub-band coding. Adaptive transform

coding, Digital audio transmission and digital audio recording. Introduction to spread spectrum communication systems direct sequence spread spectrum communication systems, frequency hoped spread spectrum systems, Other types of spread spectrum signals.

Teaching Methodology

2 hour lectures and 1 hour tutorial per week and at least three 3- hour laboratory sessions per semester organized on a rotational basis.

Mode of course assessment: Continuous assessment and written University examinations shall contribute 30% and 70%, respectively of the total marks.

Instructional Materials/Equipment

1. Telecommunications laboratory
2. LCD projector

Course Textbooks

1. Sunil Bhooshan, (2016) *Fundamentals of Analogue and Digital Communication Systems,* ASIN: B01LXOCLLI.
2. Shanmugam K.S.(2004), *Digital and Analog Communication Systems*, Wiley.
3. Mehmet Safak,(2017), *Digital Communications*, Wiley.

Course Journals

Reference Textbooks

1. Ziemer R. E. and W. H. Tranter (2014*), Principles of Communications,*Wiley.
2. Schwartz M. (1990), *Information Transmission, Modulation and Noise*, McGraw Hill Int.

Reference Journals

1. IEEE Transactions in Communications
2. Journal of Communications Network

EEEQ503 Space State Design and Digital Control 48 hrs, 1.0 units

Prerequisites:

Control Engineering/Systems

Purpose

The aim of this course is to equip the student with essential knowledge in state space design methods and digital control systems

Learning Outcomes

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

1. apply state-feedback design methods to place closed-loop poles in desired locations
2. design and implement state observers
3. apply concepts of digital control in discrete systems
4. design and implement discrete-time controllers

Course Outline

State Space Design: review of the state space system description. Controller design: Pole placement design, State observer design. Compensator design and introduction of the reference input. Integral control design for systems with pure time delay. Design case study to illustrate state space design using suitable software.

Digital control: Sampled data systems and the z-transform, inverse z-transform. Difference equations and pulse transfer functions. Mapping between the s-plane and the z-plane. Stability analysis of discrete time systems. Impulse sampling and Data holds (Zero-Order Hold, First-Order-Hold, etc). Reconstruction of signals from sampled signals - Shannon's theorem, properties of the ideal low-pass filter, frequency response of the Zero-Order-Hold. Block diagram analysis - open-loop and closed-loop systems. Controller design: direct and indirect design methods. Implementation of discrete-time controllers using microprocessors, digital signal processors and microcontrollers. State space analysis for discrete time systems. Design case study to illustrate discrete-time controller design and implementation.

Teaching Methodology:

2 hour lectures and 1 hour tutorial per week and 3 hour laboratory sessions per week organized on a rotational basis

Mode of Examination:

Continuous Assessment and Written University Examination shall contribute 30% and 70% respectively of the total marks.

Instruction materials/equipment

1. Computer Lab with MATLAB installed
2. Projector

Prescribed text books

1. Katsuhiko Ogata, (2009), Modern Control Engineering, Prentice Hall.
2. Salgado Goodwin Graebe, (2015), Control System DesignPearson India
3. Katsuhiko. Ogata, (2015) *Discrete-Time Control Systems*, Prentice Hall.
4. Charles L. Phillips, H. Troy Nagel, (2014) Digital Control System Analysis and Design, Prentice Hall.

References

1. Norman S. Nise, (2015) Control Systems Engineering, Wiley.
2. G. F. Franklin, J. D. Powell, M. Workman, (2006) Digital Control of Dynamic Systems, Ellis-Kagle Press.
3. Charles L. Phillips, Troy Nagle, James Brickley, (2015) *Digital Control System Analysis & Design*, Pearson.

EEEQ504 Wireless LANs 48 hrs, 1.0 units

Prerequisites: Introduction to Computer Science

Purpose

The aim of this course is to enable the student to:

1. understand computer networks hardware and software

2. understand the different layers of the ISO/OSI Reference model and their functions

3. understand computer networks applications and standards.

Learning Outcomes

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

1. set-up a computer network

2. explain the propagation path of a digital signal in a computer network

3. explain the different layers of the ISO/OSI Reference model and their functions

4. explain computer networks applications and standards.

Course Description

Radio technologies: overview, spread spectrum, channel sets, 802.11. IEEE standards, association process, diversity antennas. Wireless LAN topologies : What is a WLAN?, single cell of coverage, multiple cells of coverage, wireless repeater, system redundancy (Hot Standby), Peer to peer (ad hoc), multi-rate and gear shifting, overlapping coverage , 340/350 comparison, in line power, home base station. Wireless LAN products: access points, client devices, accessories basic antenna theory: directionality, gain, Cisco antennas. Client device configuration: Windows drivers, Aironet Client Utility. Basic access point configuration: access point LEDs, setup of network ports, statistics, setup of Association parameters, firmware upgrade and distribution, SNMP setup, set up of event logs. Home base station configuration: base station client utility, BSM configuration, BSE configuration, client configuration. Security: 802.11 and WEP, WEP configuration, 802.11 security issues, Next generation security, 802.1x, EAP/LEAP, radius serve.

Teaching Methodology:

2 hour lectures and 1 hour tutorial per week and 3-hour laboratorysessions per week organized on a rotational basis

Mode of Assessment: Continuous Assessment and Written University Examination shallcontribute 30% and 70% respectively of the total marks.

Instruction materials/equipment

1. Computer Laboratory
2. Projector

Prescribed text books

1. Brijendra Singh (2014), Data Communications and Computer Networks, Prentice Hall.
2. Thomas G. Robertazzi,(2017), Introduction to ComputerNetworking, Springer.

References

1. Douglas E. Comer & David L. Stevens (2015), *Internetworking with TCP/IP*, Prentice Hall.
2. William Stallings (2009), Computer Networking with Internet Protocols, Dorling Kindersley.
3. International Journal of Computer Networks & Communications

EEE Q505 Engineering Project A 96 hrs, 2.0 units

Purpose

The aim of this course is to enable the student to:

1. appreciate the applications of the theory learnt in class in addressing real world problems
2. develop the ability to identify and dene real world engineering problems
3. develop the ability to design an engineering system, component or process that meets a desired need
4. develop the ability to design, implement and test the product, using appropriate toolsand techniques
5. develop the ability to analyze, demonstrate and orally present experimental results/research findings.

Learning Outcomes

At the end of this unit, the student should be able to:

1. develop an electrical/electronic engineering project, manage and execute it
2. use relevant tools and demonstrate practical skills in implementing the project objectives
3. test and commission the designed product
4. produce a project report
5. present the project work to the departmental examination board

Course Description

Each student shall be expected to prepare a report on the project work done by him/her and present a paper highlighting the work in a seminar. The student is expected to complete the project work assigned to him/her and to submit the project report by the end of the fifth-year final semester. The report shall consist of design phase and practical phase.

Teaching Methodology:

The student will be allowed 8 hours per week to research, consult, design, fabricate, test, and analyze obtained results. Every student will make an oral presentation once every four weeks and hand in a progress report.

Instruction materials/equipment

1. Electrical and Electronics Engineering Laboratories and Workshops
2. Computer Laboratories
3. Design and Simulation Softwares
4. Internet

7.5.2.2 Power Systems Engineering

EEEQ506 Power Systems Analysis 48 hrs, 1.0 units

Prerequisites: EEE 341: Electrical Energy Systems; EEE442: Transmission and Distribution of Electrical Energy.

Purpose

The aim of this course is to enable the student to:

1. Understand protection schemes and symmetrical faults.
2. Understand corona in power system
3. Understand different sources of electrical energy.

Learning Outcomes

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

1. Explain different protection schemes.
2. Solve symmetrical faults calculations.
3. Explain corona effect and its interference with communication systems.
4. Explain different sources of energy.

Course Description

Protection-Simple symmetrical fault calculations. Purpose and main characteristics of: instrument transformers, circuit breakers and isolators, insulators and bushings. Simple protection schemes. Corona and its interference with communication systems. Energy sources - conventional power stations: Schematic arrangement, principle of working, characteristics and efficiency. Heat flow/power flow diagrams of conventional sources i.e. steam, hydro, diesel and nuclear power stations. Renewable Sources-Energy available in various forms in nature and its utilization in case of the following sources: solar, wind, water power, geothermal, biomass, biogas.

Teaching Methodology:

2 hour lecture,1 hour tutorial per week and 1 hour laboratory session.

Instruction materials/equipment

1. Power Systems Laboratory
2. Projector.

Prescribed text books

1. J. Duncan Glover, Thomas Overbye, Mulukutla S. Sarma (2016), *Power System Analysis and Design*, CL Engineering.
2. V.K. Mehta (2005), Principles of Power Systems, S.Chand& Company Ltd.

References

1. Turan Gonen,(2016), Modern Power System Analysis, CRC Press.
2. R.K. Rajput (2006), Power Systems Engineering, LAXMI Publications.

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EEEQ507 Transmission and Distribution of Electrical Energy 60 hrs, 1.25 units

Prerequisites

Vector Algebra and Diagrams

Purpose

The aim of this course is to enable the student to:

1. Provide the student with the understanding of power system transmission distribution
2. Know how to perform power system design calculations
3. Explain various types of power system control
4. Prepare the student for advanced power system study and design

Learning outcomes

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

1. Describe the various types of transmission and distribution systems
2. Develop basic design of transmission and distribution systems
3. Perform calculations based on transmission and distribution systems
4. Describe the various control strategies for power system

Course description

Maxwell's equation, Pointing theorem- concept and applications. Transmission line parameters, performance, regulation and efficiency. Tuned power lines, propagation constant, power circle diagrams of constant voltage lines (both sending and receiving), maximum power transmitted..

Voltage control techniques in transmission systems- static VAR compensator, recent trends in FACTS. HVDC transmission - types of links, advantages, converter stage equipment. Mechanical design of overhead lines- line supports, overhead line insulators, classification, voltage distribution in suspension insulators, testing of insulators, string efficiency, stress and sag calculations, effect of wind and ice stringing chart. Corona-formation of corona, critical voltage, losses, effect on line performance. Distribution - A.C. single phase and three phase distribution systems, calculation of voltage drops, Kelvins law and its limitations, distribution systems, classification, and distribution automation.

Teaching methodology

3 hour lecture and 1 hour tutorial per week

Mode of course assessment

Continuous assessment and written University examinations shall contribute 30% and 70% respectively of the total marks

Instructional materials/Equipment

1. LCD Projector
2. Power system Model Lab

Course textbooks

1. Turan Gonen,(2014)*Electrical Power Transmission System Engineering: Analysis and Design,* CRC Press.
2. V.K Mehta and Rohit Mehta (2012), *Principles of Power System,* S. Chand and Company Ltd,4th Edition
3. Leonard L. Grigsby**,**(2016) *Electric Power Generation, Transmission, and Distribution,* CRC Press.

Reference textbooks

1. Pradip Kumar Sadhu, Soumya Das, (2015) *Elements of Power Systems*, CRC Press.

2. Sriram Kalaga, Prasad Yenumula, (2016) *Design of Electrical Transmission Lines: Structures and Foundations*, CRC Press

EEEQ508 Protection and Switchgear 48 hrs, 1.0 units

Prerequisites: EEE 341: Electrical Energy Systems; EEE442: Transmission and Distribution of Electrical Energy.

Purpose

The aim of this course is to enable the student to:

1. Understand different types of relays.
2. Understand different types of circuit breakers.
3. Understand over current and overvoltage protection.

Learning Outcomes

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

1. Explain principles of operation of different types of relays.
2. Explain working of different types of protection schemes.
3. Explain working of different types of circuit breakers.
4. Explain different methods of over current and overvoltage protection.
5. Solve problems on protection and switch gear.

Course Description

Relays: principle of operation, types, characteristics, torque equation, electromagnetic and solid state relays, relaying schemes. Apparatus and line protection: feeder protection, ring main protection, bus bar protection, carrier current protection of transmission lines, generator and transformer protection. Protection against over voltages: ground wires, surge absorbers and diverters. Earthing: neutral earthing, insulation coordination. Circuit breakers: theory of arc quenching and circuit breakers, rating of CB, RRRV, types of circuit breakers. Design of transmission lines: electrical parameters, inductance and capacitance of three phase, multicircuit untransposed and unequally spaced lines. Mechanical design, sag and tension calculations. Symmetrical components: basic theory of symmetrical components. Characteristics of transmission lines. Synchronous machines and transformers in terms of unsymmetrical fault calculations. Protection: over current protection (simple & directional),

distance (impedance) protection, differential protection. Carrier-current protection. Earth-fault and sequence protection. Over voltage and insulation co-ordination: atmospheric over voltages and introduction to protection against these. Switching over-voltages. Travelling waves and lightning over - voltages. Insulation co-ordination and protection against over-voltages.

Teaching Methodology:

2 hour lecture,1 hour tutorial per week and 1 hour laboratory session.

Instruction materials/equipment

1. Power Systems Laboratory
2. Projector.

Prescribed text books

1. J. Duncan Glover, Thomas Overbye, Mulukutla S. Sarma (2016), Power System Analysis and Design, CL Engineering.
2. V.K. Mehta (2005), Principles of Power Systems, S.Chand & Company Ltd.

References

1. Turan Gonen, (2016), Modern Power System Analysis, CRC Press.
2. R.K. Rajput (2006), Power Systems Engineering, LAXMI Publications.

7.5.2.3 Telecommunication Systems Engineering Option

EEEQ509 Antennae Theory and Design 48 hrs, 1.0 units

Prerequisites

EEEQ339 Electromagnetic Fields

Purpose

The aim of this course is to enable the student to;

1. provide the student with an understanding of basic theory of a transmitting and receiving antennae.
2. know how to perform basic antenna measurements.
3. prepare for more advanced work in RF and microwave engineering, ultra-fast integrated circuits, and optics.

Learning Outcomes

At the end of this course, the student should be able to;

1. to select suitable antenna devices for different tasks.
2. to apply the acquired knowledge and skills gained through laboratory practices and industrial attachment to design and construct and simple antenna components.

Course Description

Radiation fundamentals: electrodynamics, retarded potentials. Transmitting antennas: radiation from a Hertzian dipole; near field and far-field calculation, radiation resistance, antenna patterns, antenna parameters, and straight – wire antennae (wave dipoles). Basic antenna types: dipole antennae; loop antennae; Huygens radiator. Aperture antennae: surface equivalence principle. Horn antennae, parabolic dish antennae, helical antennae, broadband antennae. Antenna arrays: Principle of pattern multiplication. Linear uniform arrays. Synthesis of non-uniform arrays. Smart Antennas: Definition. Overview of antenna systems. Diversity systems. Switched beam antennas. Receiving antennae: Reciprocity, antenna temperature, noise and radio astronomy. Feed networks: a quarter wave section.

Teaching Methodology

2 hour lectures and 1 hour tutorial per week, and at least five 3-hour laboratory sessions per semester organized on a rotational basis.

Mode of course assessment: Continuous assessment and written University examinations shall contribute 30% and 70%, respectively of the total marks.

Instructional Materials/Equipment

1. Communication Lab
2. LCD projector

Course Textbooks

1. C. A. Balanis (2016*), Antenna Theory- Analysis & Design*, Wiley & Sons.
2. Robert E. Collin (1985), *Antennas &Radio wave Propagation*, McGraw-Hill, 4th Ed.

Course Journals

Reference Textbooks

1. Hubregt J. Visser,(2012), *Antenna Theory and Applications*, Wiley.
2. Constantine A. Balanis,(2015) *Antennae Theory and Design*, Wiley.
3. I.J. Bahl and P. Bhartia (1980), *Microstrip*, Artech House.
4. Simon Ramo, John R. Whinnery (1994), *Fields and Waves in Communication Electronics*, John Wiley & Sons.

Reference Journals

1. IEEE Antennas and Wireless Propagation Letters
2. International Journal of Antenna and Propagation
3. Radio Engineering

EEEQ510 Wireless Communication 48 hrs, 1.0 units

Prerequisites

EEEQ339 Electromagnetic Fields

Purpose

The aim of this course is to enable the student to;

1. understand the differences between cellular telephone generations
2. know the ITU standards relevant to mobile communications
3. design cellular mobile telephone systems

Learning Outcomes

At the end of this course, the student should be able to;

1. Describe the characteristics of cellular telephone generations.
2. Describe the channelization methods used in cellular mobile communications
3. Perform traffic and link budget calculations for cellular telephone systems

Course Description

Introduction to mobile communication systems. Cellular concept and system design fundamentals, channel assignment strategies, Hand-off strategies. Interference and system capacity. Improving capacity in cellular systems. Mobile radio propagation, Ground reflection model, diffraction sculpturing, Indoor propagation models, outdoor propagation models, ray tracing and site specific signalling. Modulation techniques for mobile radio, diversity and channel coding. RAKE receiver multiple access techniques for mobile communication, capacity of cellular systems. Introduction to wireless networking Development of wireless network, wireless data services, Common channel signalling. Protocols for network access network databases. Universal mobile telecommunication systems. Wireless systems and standards.

Teaching Methodology

2 hour lectures and 1 hour tutorial per week and at least three 3- hour laboratory sessions per semester organized on a rotational basis.

Mode of course assessment: Continuous assessment and written University examinations shall contribute 30% and 70%, respectively of the total marks.

Instructional Materials/Equipment

1. Telecommunications laboratory
2. LCD projector

Course Textbooks

1. Garg V.K. & Wilkes J. E. (2009), *Principles and Applications of GSM*, Pearson Education
2. Karim M.R. & Sarraf M. (2002), *W-CDMA and CDMA 2000*, McGraw Hill

Course Journals

Reference Textbooks

1. Garg V.K. & Wilkes J.E, (1996), *Wireless and Personal Communications Systems*, Prentice Hall PTR
2. Schiller J. (2007), *Mobile Communications*, 2nd Ed, Pearson Education

Reference Journals

1. IEEE Transactions on Wireless Communications
2. EURASIP Journal on Wireless Communications and Networking
3. Mobile Networks and Applications
4. Communications Engineering and Design Magazine
5. IEEE Wireless Communications Magazine

EEEQ511 Multimedia Communication 48 hrs, 1.0 units

Prerequisites: EEEQ 352: Digital Communication

Purpose

The aim of this course is to enable the student to:

1. understand the basics of multimedia technology

2. understand image compression and standards

3. understand the digitization of sound

4. understand various applications of multimedia systems.

Learning Outcomes

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

1. explain the process of image compression

2. explain how sound is digitized

3. explain the applications of multimedia systems.

Course Description

Introduction to basics of packet switching technologies & their applications to multimedia communications, design model for internet protocol such as IP and TCP. Network access technologies: routing and switching, protocols (such as SMTP, FTP, HTTP). Information coding, multimedia hardware, networked multimedia: ergonomics, interface design, multimedia applications. Cable TV systems, Closed Circuit Television (CCTV); master antenna; community antenna design and installation of the same; frequency synthesis. AFT and remote control; the Quasar compumatic tuning system, compumatic circuit analysis, AFT; remote control system. Colour TV operation, applying micro-controllers in TV circuitry; multi-media communications; overview of TV and video, analog video, digital video, overview of compression techniques image, compressor, JPEG standard, MPEG standard; MPEG compression of moving images; audio compression, vocoders CELP technique; standards for speech ITU-TS; G.721, 722, 723, 728. Multimedia broadcasting; video conferencing. Multimedia Management Systems.

Teaching Methodology: 2 hour lectures and 1 hour tutorial per week and 3 hour laboratory sessions per week organized on a rotational basis

Mode of Examination:

Continuous Assessment and Written University Examination shallcontribute 30% and 70% respectively of the total marks.

Instruction materials/equipment

1. Computer Laboratory
2. Projector

Prescribed text books

1. Hans W. Barz, Gregory A. Bassett, (2016) *Multimedia Networks: Protocols, Design and Applications,* Wiley.
2. John Villamil-Casanova, Louis Molina (1997), Multimedia Production, Planning andDelivery, Prentice Hall, ISBN: 8120313178

3. Tay Vaughan (2014), Multimedia: Making it Work, McGraw-Hill.

References

1. Sinclair (1995), Multimedia on The PC, BPB, ISBN: 817029441X

2. Parag Havaldar, Gerard Medioni (2009), Multimedia Systems, Cengage Learning.

3. International Journal of Multimedia and Ubiquitous Engineering

7.5.2.3 Instrumentation and Control Engineering Option

EEEQ512 Artificial Neural Networks 48 hrs, 1.0 units

Prerequisites

None

Purpose

The aim of this course is to enable the student to;

1. understand the fundamentals and types of Knowledge Based Systems
2. understand the use of fuzzy logic and neural networks

Learning Outcomes

At the end of this course, the student should be able to;

1. use fuzzy logic and neural networks in design of systems
2. artificial intelligence in design telecommunication systems

Course Description

Introduction: objectives, history, use of neural networks, biological inspiration, neural physiology, neuron models -MeCulloth and Pitts model, activation functions - input neuron, multi-input neuron. Network architectures, a layer of neuron, multiple layers of Neurons. Perceptron architecture: single-neuron perceptron, multi-neuron perceptron, perceptron learning rule, constructing learning rules, training multiple-neuron perceptrons. Simple associative networks: unsupervised Hebb rule with Decay-Instar rule, Outstar Rule, Kohonen Rule. Adaline networks.

Teaching Methodology

2 hour lectures and 1 hour tutorial per week, and at least five 3-hour laboratory sessions per semester organized on a rotational basis.

Mode of course assessment:

Continuous assessment and written University examinations shall contribute 30% and 70%, respectively of the total marks.

Instructional Materials/Equipment

1. Computer Lab
2. LCD projector

Course Textbooks

1. Stuart Jonathan Russell, Peter Norvig and John F. Canny (2015), *Artificial Intelligence: A Modern Approach*,Prentice Hall.
2. Rajendra Akerkar,(2014), *Introduction to Artificial Intelligence*, PHI Learning.

Course Journals

Reference Textbooks

1. Nils J. Nilsson (2010), *Artificial Intelligence: a new synthesis*, Morgan Kaufmann.
2. Alison Cawsey (2010), *The Essence of Artificial Intelligence*, Prentice Hall.

Reference Journals

1. International Journal of Knowledge-Based and Intelligent Engineering Systems
2. Artificial Intelligence
3. Applied Soft Computing
4. Advances in Fuzzy Systems
5. Engineering Intelligent Systems
6. Engineering Applications of Artificial Intelligence

EEEQ513 Industrial Programmable Logic Controllers 48 hrs, 1.0 units

Prerequisites

1. EEEQ 474 Microprocessor Systems B
2. EEEQ 432 Embedded Systems

Purpose

The aim of this course is to enable the student to:

1. to learn the functions and applications of Programmable Logic Controllers (PLCs), their installation and configuration

Learning Outcomes

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

1. describe the general architecture and working of PLCs
2. explain the functions and applications of PLCs
3. program, download and apply PLCs in industrial automation
4. install and configure PLCs
5. interface PLCs with other system hardware
6. describe the architecture of S7 300 PLC

Course Description

Introduction: PLC block diagram, scan sequence and I/O latency, program memory and data tables, ladder diagrams, Boolean statements, PLC software, binary logic systems including combinational logic network, memory elements, timing and counting functions, logic diagram translations. PLC functions: combinational logic functions, timer and counting functions, initialization pulses, alarms and interlocks, safety monitoring, trip and permissive systems, redundant or voting systems, bypass and points of failure, specifications. PLC installation: manufacturers data, wiring requirements, safety principles, wiring redundant interlocks, I/O wiring. Industrial automation (IA): IA systems, PLC programming of IA systems, program download, use of programmable terminal (PT). The S7 300 PLC: architecture, function of modules, hardware configuration, communication with ASI and bus network topologies, use of

MPI and Ethernet systems, use and applications OBs, FBs, FC, SFC, and SFBs blocks, use of HMI devices.

Teaching Methodology

2 hours of lectures per week will be used to introduce material on the formal aspects of the unit

1 hour tutorial per week, at least five 3-hour laboratory sessions per semester organized on rotational basis, students will research and present their findings on various topicsdiscussions and working out problems

Mode of Course Assessment:

Continuous assessment and written University examinations shall contribute 30% and 70% respectively of the total marks

Instructional Materials/Equipment

1. Industrial PLCs such as Toshiba and Siemens PLCs
2. PLC programming and simulations software for PLCs such as Toshiba and Siemens
3. PLC training kit

Course Textbooks

1. Frank Petruzella,(2016) *Industrial Programmable Logic Controllers,* McGraw-Hill Education.
2. Elvin Pérez Adrover, (2012) Introduction to PLCs: A beginner's guide to Programmable Logic Controllers, Elvin Perez Adrover.
3. Orlando Charria, (2012) Fundamentals of Programmable Logic Controllers and Ladder Logic (Volume 1), Latin Tech Inc.
4. Frank Petruzella, (2016) Programmable Logic Controllers, McGraw-Hill.

Reference Textbooks

1. Frank Petruzella, (2010) Activities Manual to accompany Programmable Logic Controllers, McGraw-Hill.
2. Muguo Li Lei Wang, (2016) Industrial Automated Systems: Instrumentation and Motion Control, Auris Reference.
3. W. Bolton, (2015) Programmable Logic Controllers, Newnes.

Reference Journals

1. The Principle of Programmable Logic Controller and its role in Automation, International Journal of Engineering Trends and Technology, Volume 4, Issue 3, 2013
2. PLC and its applications, International Journal of Multidisciplinary Sciences and Engineering, Volume 2, No. 8, November, 2011
3. Conveyor Control Using Programmable Logic Controller, International Journal of Advancements in Research & Technology, Volume 3, Issue 8, August, 2014
4. International Journal of Engineering Trends and Technology
5. IEEE Control Systems Society
6. International Journal of Information and Computer Science
7. International Journal of Computer Applications.

EEEEQ514 Instrumentation and Biomedical Systems 48 hrs, 1.0 units

Purpose

The aim of this course is to enable the student to:

1. understand the generalised performance of instrumentation systems

2. understand the use of actuators and transducers in instrumentation systems used in the medical field.

Learning Outcomes

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

1. explain the structure and operation of instrumentation systems

2. explain the use of actuators and transducers in instrumentation systems used in the medical field

3. explain the use of remote sensing and telemetry techniques and systems used in the medical field

Course Description

Introduction: transducer terminology, general transducer characteristics, design characteristics, performance characteristics, reliability characteristics, criterion for transducer selection – temperature, pressure, level, flow displacement, acceleration, speed, and power parameter. Signal conditioning design: 3-stage instrumentation amplifier, modulators and demodulators, S/H circuits. Active filter types. Design of Butterworth filter for 3rd order. Interfacing microprocessor-based system design for temperature and pressure; PC-based system design for thermal power station and cement plant. An introduction to basic concepts in biomedical instrumentation, blood flow measurements, bio-potential amplifiers, and electrodes as well as electrical safety of medical equipment. Equipment for diagnosis, monitoring and surgery of the heart such as electrocardiographs, cardiac monitors, defibrillators and pacemakers, blood pressure measurement, cardiac catheterization, electro-surgical units, imaging systems, medical instrument maintenance and safety. Types of medical imaging principles and their applications in diagnostic therapy, radiology such as ultrasound imaging, X-ray and Magnetic Resonance Imaging (MRI). Bio-informatics. processing, tools and their applications in diagnosis. The rationale for technologies, issues and trends in telemedicine.

Teaching Methodology:

2 hour lectures and 1 hour tutorial per week and 3 hour laboratory sessions per week organized on a rotational basis

Mode of Examination:

Continuous Assessment and Written University Examination shall contribute 30% and 70% respectively of the total marks.

Instruction materials/equipment

1. Control Engineering Laboratory
2. Electronics Laboratory

3. Projector

Prescribed text books

1. J.B.Gupta (2015), Electronics Measurements& Instrumentation, Dhanpat Rai& Co. (p) Ltd.
2. Roman Malaric, (2011), Instrumentation and Measurement in Electrical Engineering, Brown Walker Press.

References

1. John G. Webster, Halit Eren, (2016) Measurement, Instrumentation, and Sensors Handbook, CRC Press.
2. Alan S. Morris (2005), Measurement & Instrumentation Principles, Elsevier India Private Limited.
3. J. B. Gupta (2006), A Course in Electronics and Electrical Measurements and Instrumentation, S. S. K. Kataria & Sons.

Journal of Instrumentation

7.5.2.4 Electronic and computer engineering

EEEQ515 Distributed Computing and Networks 48 hrs, 1.0 units

Prerequisites

ETI 2313 Data Communications

ETI 2301 Computer Networks

Purpose

The aim of this course is to enable the student to;

1. understand basic concepts of distributed and network operating systems
2. understand transaction, failures and models of distributed systems

Learning Outcomes

At the end of this course, the student should be able to;

1. apply use of distributed and network operating systems in telecommunication

2. implement naming service and distributed file systems

Course Description

The characteristics and objectives of distributed systems. Distribution of data, management, control; maintenance and administration. Network support requirements. Network owners vs network users. Processors and processes. Process communication and resource sharing. Communication primitives. Application oriented services. Virtual processors, virtual file service, virtual terminal service, job transfer, their design and implementation. Networked computer applications support, synchronization issues such as global state, election, inter-process communication, distributed mutual exclusion, distributed transaction mechanisms. Consistency models and protocols and replication. Fault tolerance and cryptographic security. Fault models, reliable multicast, commit, check-pointing, recovery, access control.

Teaching Methodology

2 hour lectures and 1 hour tutorial per week, and at least five 3-hour laboratory sessions per semester organized on a rotational basis.

Mode of course assessment:

Continuous assessment and written University examinations shall contribute 30% and 70%, respectively of the total marks.

Instructional Materials/Equipment

1. Presentation software
2. LCD projector

Instructional Materials/Equipment

1. Computer Lab
2. LCD projector

Course Textbooks

1. Garg Vijay K. (2014), *Elements of Distributed Computing,* Wiley India.
2. Françoise André (1985), *Distributed Computing Systems: Communication, Cooperation, Consistency*, Elsevier Science.

Course Journals

Reference Textbooks

1. Costin Badica and Giuseppe Mangioni (2010), *Intelligent Distributed Computing, Systems and Applications*, Springer.
2. Mei-Ling L. Liu (2003), *Distributed Computing: Principles and Applications*, Pearson/Addison Wesley.

Reference Journals

1. INFORMS Journal of Computing
2. IETE Journal of Research
3. **Journal of Computer Science**

EEEQ516 Industrial Programmable Logic Controllers 48 hrs, 1.0 units

Prerequisites

1. EEEQ 474 Microprocessor Systems B
2. EEEQ 432 Embedded Systems

Purpose

The aim of this course is to enable the student to:

1. to learn the functions and applications of Programmable Logic Controllers (PLCs), their installation and configuration

Learning Outcomes

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

1. describe the general architecture and working of PLCs
2. explain the functions and applications of PLCs
3. program, download and apply PLCs in industrial automation
4. install and configure PLCs
5. interface PLCs with other system hardware
6. describe the architecture of S7 300 PLC

Course Description

Introduction: PLC block diagram, scan sequence and I/O latency, program memory and data tables, ladder diagrams, Boolean statements, PLC software, binary logic systems including combinational logic network, memory elements, timing and counting functions, logic diagram

translations. PLC functions: combinational logic functions, timer and counting functions, initialization pulses, alarms and interlocks, safety monitoring, trip and permissive systems, redundant or voting systems, bypass and points of failure, specifications. PLC installation: manufacturers data, wiring requirements, safety principles, wiring redundant interlocks, I/O wiring. Industrial automation (IA): IA systems, PLC programming of IA systems, program download, use of programmable terminal (PT). The S7 300 PLC: architecture, function of modules, hardware configuration, communication with ASI and bus network topologies, use of MPI and Ethernet systems, use and applications OBs, FBs, FC, SFC, and SFBs blocks, use of HMI devices.

Teaching Methodology

2 hours of lectures per week will be used to introduce material on the formal aspects of the unit: - 1 hour tutorial per week, at least five 3-hour laboratory sessions per semester organized on rotational basis, students will research and present their findings on various topicsdiscussions and working out problems.

Mode of Course Assessment:

Continuous assessment and written University examinations shall contribute 30% and 70% respectively of the total marks

Instructional Materials/Equipment

1. Industrial PLCs such as Toshiba and Siemens PLCs
2. PLC programming and simulations software for PLCs such as Toshiba and Siemens
3. PLC training kit

Course Textbooks

1. Frank Petruzella, (2016) Industrial Programmable Logic Controllers, McGraw-Hill Education.

2. Elvin Pérez Adrover, (2012) Introduction to PLCs: A beginner's guide to Programmable Logic Controllers, Elvin Perez Adrover.
3. Orlando Charria, (2012) Fundamentals of Programmable Logic Controllers and Ladder Logic (Volume 1), Latin Tech Inc.
4. Frank Petruzella, (2016) Programmable Logic Controllers, McGraw-Hill.

Reference Textbooks

1. Frank Petruzella, (2010) Activities Manual to accompany Programmable Logic Controllers, McGraw-Hill.
2. Muguo Li Lei Wang, (2016) Industrial Automated Systems: Instrumentation and Motion Control, Auris Reference.
3. W. Bolton, (2015) Programmable Logic Controllers, Newnes.

Reference Journals

1. The Principle of Programmable Logic Controller and its role in Automation, International Journal of Engineering Trends and Technology, Volume 4, Issue 3, 2013
2. PLC and its applications, International Journal of Multidisciplinary Sciences and Engineering, Volume 2, No. 8, November, 2011
3. Conveyor Control Using Programmable Logic Controller, International Journal of Advancements in Research & Technology, Volume 3, Issue 8, August, 2014
4. International Journal of Engineering Trends and Technology
5. IEEE Control Systems Society
6. International Journal of Information and Computer Science
7. International Journal of Computer Applications

EEEQ517 Multimedia Communications 48 hrs, 1.0 units

Prerequisites: EEEQ 352: Digital Communication

Purpose

The aim of this course is to enable the student to:

1. understand the basics of multimedia technology

2. understand image compression and standards

3. understand the digitization of sound

4. understand various applications of multimedia systems.

Learning Outcomes

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

1. explain the process of image compression

2. explain how sound is digitized

3. explain the applications of multimedia systems.

Course Description

Introduction to basics of packet switching technologies & their applications to multimedia communications, design model for internet protocol such as IP and TCP. Network access technologies: routing and switching, protocols (such as SMTP, FTP, HTTP). Information coding, multimedia hardware, networked multimedia: ergonomics, interface design, multimedia applications. Cable TV systems, Closed Circuit Television (CCTV); master antenna; community antenna design and installation of the same; frequency synthesis. AFT and remote control; the Quasarcompumatic tuning system, compumatic circuit analysis, AFT; remote control system. Colour TV operation, applying micro-controllers in TV circuitry; multi-media communications; overview of TV and video, analog video, digital video, overview of compression techniques image, compressor, JPEG standard, MPEG standard; MPEG compression of moving images; audio compression, vocoders CELP technique; standards for speech ITU-TS; G.721, 722, 723, 728. Multimedia broadcasting; video conferencing. Multimedia Management Systems.

Teaching Methodology: 2 hour lectures and 1 hour tutorial per week and 3-hour laboratory sessions per week organized on a rotational basis

Mode of Examination:

Continuous Assessment and Written University Examination shall
contribute 30% and 70% respectively of the total marks.

Instruction materials/equipment

1. Computer Laboratory
2. Projector

Prescribed text books

1. Hans W. Barz, Gregory A. Bassett, (2016) Multimedia Networks: Protocols, Design and Applications, Wiley.
2. John Villamil-Casanova, Louis Molina (1997), Multimedia Production, Planning and Delivery, Prentice Hall.
3. Tay Vaughan (2014), Multimedia: Making it Work, McGraw-Hill.

References

1. Sinclair (1995), Multimedia on The PC, BPB, ISBN: 817029441X
2. Parag Havaldar, Gerard Medioni (2009), Multimedia Systems, Cengage Learning.
3. International Journal of Multimedia and Ubiquitous Engineering

Semester III

7.5.3.1 Compulsory Courses

EEEQ518 Professional Engineering Practice 48 hrs, 1.0 units

None

Purpose

The aim of this unit is to enable the learner to:

1. understand the impact of engineering solutions in a global, economic, environmental, and societal content
2. recognize the need for, and an ability to engage in life-long learning.

Learning outcomes

At the end of this unit learner should be able to:

1. communicate effectively.
2. identify and formulate engineering problems
3. understand of professional and ethical responsibility
4. use the techniques, skills, and modern engineering tools necessary for electrical engineering practice.

Course description

Financial, legal, regulatory, human resource ethical and business aspects of engineering practice. Office organisation and management. Human resource management. Professional societies. engineering registration. The role of engineering in development. Ethics and integrity in engineering practice.

Teaching Methodology

- Overhead projector
- Lecture room
- Four Lab per semester

Modes of course assessment

Coursework for the unit shall be by continuous assessment and shall be defined as comprising assignments and continuous assessment tests and University examination to contribute 40% and 60% respectively for the total marks.

Instructional materials/Equipment

1. Overhead projector
2. Lecture room

Reference Textbooks

EEEQ519 Microelectronics and VLSI Design 60 hrs, 1.25 units

Prerequisites

1. Electronic Design and Fabrication.
2. Microprocessors and Digital Design

Purpose

The aim of this course is to enable the student to:

1. Understand the evolution of discrete components, the semiconductor devices leading to the integrated circuit technology.
2. Select and design circuits from the available semiconductor devices for different tasks

Learning outcomes

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

1. Design working systems based on the VLSI technology.
2. Construct and test working prototypes.
3. Diagnose, repair and maintain industrial systems.

Course Description

Review of microelectronics and VLSI fabrication process; design and VLSI transistors and layout; CMOS and Bi CMOS devices building blocks, review of NMOS and CMOS; inverters and gate design CMOS processing technology - design review ofmicroelectronics and VLSI fabrication process. Digital systems and VLSI transistors and layout. MOS and Bi CMOS devices basic building blocks. Review of rules and tools, combinational logic function. Static complementary gates, switch logic; combinational logic networks, sequential machines. Circuit characterization and performance estimation, chip design options, design verification tools. Testing; design strategies for test, chip level test techniques, system level techniques; Design examples like, ALU pipeline architecture and other major blocks. CAD and simulation algorithm for VLSI. Introduction and basis of VHDL and other design & synthesis tools.

Teaching Methodology

Two 2-hour lectures and 1 hour tutorial per week, and at least five 3-hour laboratory sessions per semester organised on a rotational basis.

Mode of course assessment:

Continuous assessment and written University examinations shall contribute 40% and 60%, respectively of the total marks.

Instructional Materials/Equipment

1. Microprocessors Lab.
2. LCD Projector presentation.

Course Textbooks

1. Nikolic Rabae Chandrakasan, (2017) Digital Integrated Circuits: A Design Perspective, Pearson Education India.
2. Douglas, A. Pucknell, and Camran, Eshraghlan, "*Basic VLSI design*", Prentice Hall of India, New Delhi, 3rd edition, 2004.
3. Deepak Garg, (2015) Basics of VLSI Design with VHDL.
4. Mano, M.M. and C.R. Kime, (2015)*Logic and Computer Design Fundamentals*, Upper Saddle River.
5. Adel S. Sedra, Kenneth C. Smith, (2014) Microelectronic CircuitsOxford University Press.

Course Journals

Reference Textbooks

1. Stephen Brown and ZvonkoVranesic (2005), *Fundamentals of Digital Logic with VHDL Design*, 2nded.
2. M. Morris Mano, (2006), *Computer System Architecture*, 3rded.
3. Sarah Harris, David Harris, (2015) Digital Design and Computer Architecture, Morgan Kaufmann.

Reference Journals

1. IEEE Transactions on Very Large Scale Integrated (VLSI) systems.
2. IEEE Solid-State Circuits Magazine.
3. IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems.

EEEQ520 Engineering Project B 96 hrs, 2.0 units

Prerequisites

Successful completion of all units from first year to fifth year of study.

Purpose

The objective is to confront the student with a real-world engineering problem in order to consolidate skills in problem definition, analysis, design, construction, measurement, evaluation and communication. The project work will be selected so as to reflect the requirements for specially creative and analytical approaches. Students are expected to work largely on their own initiative.

Learning outcomes

At the end of this course the students will come up with a project and a report that must have the following components;

1. design
2. fabrication
3. testing

Course Description

Project design and Fabrication- Internal evaluation. The student is expected to complete the design, assembly and testing of the project and submit the design phase report and give an oral presentation and a demonstration on the functioning of the project to a panel of examiners. The number of students undertaking a particular project shall be limited to a maximum of two students. The project seminar presentation is expected to cover any or all of the following topics: Electronics, Communication, Electronic instrumentation, power systems.

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Course regulation

The project unit will have the following components for regulating it implementation:

(i) Project proposal and examination. Examinable components include proposal write up and oral presentation.

(ii) Project implementation in consultation with the supervisor

(iii) Project final examination. The examinable components include dissertation write up, oral presentation and project demonstration.

Teaching methodology:

The students will be allowed a day (8 hours) per week to research, design and fabricate, and consult with the supervisors. Another 2 hours are allowed every week for the students to present their progress reports on rotational basis. Academic staff members will usually attend.

7.5.3.1 Power Systems Engineering Option

EEEQ521 Economics of Power Supply and Load Flow Studies 48 hrs, 1.0 units

Prerequisites:

EEEQ 304 Numerical Methods, EEEQ 442 Transmission and Distribution of Electrical Energy

Purpose

The aim of this course is to enable the student to:

1. understand the formulation and solution of the power ow problem
2. understand power system stability
3. understand the principles of economic load dispatch
4. understand electricity markets and the role of the market. regulator

Learning Outcomes

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

1. model power systems for load ow solution
2. use power system simulation tools for power ow solutions
3. analyze steady state and transient stability of the single-machine infinite bus system
4. explain the causes of voltage instability and corrective measures
5. solve simple economic dispatch problems
6. explain electricity market design and the role of the market regulator.

Course Description

Power Systems Stability- Power transfer and steady state stability. Transient stability, the swing equation and the equal area criterion for stability. Methods of improving power system stability. Power System Economics-Load curves and maximum demand, station operating schedule. Plant capacity and plant use factors. Economics of power generation, cost of electrical energy, methods of determining depreciation, importance of high load factor. Forecast of load growth co-ordination of different types of plant. Introduction to optimum economic dispatch solutions using digital computers. Load Flow Studies-The mesh current method and connection matrices. the nodal voltage method to the solution of power load flow problems. Direct method of solving load flow problem on digital computers. Analogue methods for solving load flow problems.

Teaching Methodology:

2 hour lecture and 1 hour tutorial per week and at least three3-hour laboratory sessions per semester organized on a rotational basis

Instruction materials/equipment

1. Power System Laboratory
2. Computer Laboratory
3. Simulation Software e.g. Power System Toolbox (MATLAB based), Power-Factory, Power-World
4. Projector

Prescribed text books

1. W. Stevenson,(2014) Elements Of Power System Analysis Paperback, Mcgraw Hill Education.
2. John Grainger, Jr. William Stevenson, Gary W. Chang,(2015) Power Systems Analysis,McGraw-Hill Education.
3. Leonard L. Grigsby,(2016), Power System Stability and Control, CRC Press.
4. Turan Gonen,(2016), Modern Power System Analysis, CRC Press.

References

1. G. T. Heydt (1986), Computer Analysis Methods for Power Systems, Macmillan ISBN: 0023528605

2. Charles A. Gross (2013), Power System Analysis, Wiley.

3. International Journal of Electrical Power & Energy Systems

EEEQ522 Electrical Machine Drives 48 hrs, 1.0 units

Prerequisites:

EEEQ 342 DC Machines and Transformers,

EEEQ 543 Induction Machines,

EEEQ 545 Synchronous and Special Machines

Purpose

The aim of this course is to enable the student to:

1. understand the principle of operation of DC and AC machine drives

2. understand the applications of DC, AC and special purpose machine drives.

Learning Outcomes

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

1. explain the performance and electronic control of DC machine drives

2. explain the performance and electronic control of AC machine drives

3. explain the applications of DC, AC and special purpose machine drives.

Course Description

DC Machines Drives: DC machine drive dynamics and performance equations, DC machine drive systems. Electronic control of DC drives using rectifier and choppers. Two and four quadrant chopper control for DC machine drives. Transfer function of DC machine drive systems. Speed and current feedback control systems for DC machines drives. Microprocessor control systems for DC machine drives. Application of DC machine variable speed drives in traction including railway traction, lifts etc. AC Machine Drives- AC Machine drive dynamics and performance equation. AC machine drive systems, induction motor drives. Synchronous motor drives.

Electronic control of AC drives using inverters. Harmonic distortion and losses. Control of frequency, voltage and power. Transfer functions of AC machine drive systems with speed, current, flux feedback. Microprocessor control of AC machine drives. Applications of AC machine variable speed drives.

Teaching Methodology:

2 hour lecture and 1 hour tutorial per week and at least three

3-hour laboratory sessions per semester organized on a rotational basis

Instruction materials/equipment

1. Electrical Machines Laboratory

2. Projector

Prescribed text books

1. Andre Veltman, Duco W.J. Pulle, R.W. de Doncker, (2016) Fundamentals of Electrical Drives (Power Systems), Springer

2. El-Sharkawi (2016), Fundamentals of Electric Drives, Cengage Learning (Thompson), ISBN: 8131510042

2. Muhammad H. Rashid (2014), Power Electronics: Circuits, Devices and Applications,Prentice Hall, ISBN: 0131011405

References

1. Ion Boldea, Syed A. Nasar (2016), Electric Drives,CRC Press.

2. Austin Hughes (2016), Electric Motors and Drives, Elsevier India Private Limited, ISBN: 8131206688

3. IEEE Transactions on Power Electronics

EEEQ523 Electrical Machines Design 48 hrs, 1.0 units

Prerequisites:

EEEQ 342: DC Machines and Transformers, EEEQ 226 Material Science

Purpose

The aim of this course is to enable the student to:

1. understand machine design procedure

2. appreciate the need for maintenance of induction motors and transformers.

Learning Outcomes

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

1. design and wind motors and transformers

2. carry out standard tests and commissioning

3. explain the need for routine maintenance of induction motors and transformers.

Course Description

Materials for electric and magnetic circuits and their characteristics: Transformer design : core; windings; connections; loading and performance parameters; design of rotating dc and ac machines; magnetic circuit consideration, power/weight ratio.

Design of armature windings for ac and dc machines; stator and rotor design; effects of harmonics produced by winding arrangement and how they can be avoided; Temperature rise and cooling of electrical machines; principle of application of computer in design, emerging trends in machine design

Teaching Methodology: 2 hour lecture and 1 hour tutorial per week and at least three3-hour laboratory sessions per semester organized on a rotational basis

Instruction materials/equipment

1. Electrical Installation Workshop

2. Electrical Machines Laboratory

3. Projector

4. Design Software (CAD/CAM)

Prescribed text books

1. V. N. Mittle (2009), Design of Electrical Machines, Standard Publishers Distributors, ISBN: 8180141268

2. Thomas A. Lipo,(2017) Introduction to AC Machine Design,Wiley-IEEE Press

3. J. Pyrhonen, T. Jokinen, V. Hrabovcova (2017), Design of Rotating Electrical Machines, John Wiley & Sons Inc.

References

1. J. Shigley, C. Misschke, T. Brown (2004), Standard Handbook of Machine Design, 3rdEd., McGraw-Hill Professional, ISBN: 0071441646

2. M. V. Deshpande, (2009) Design and Testing of Electrical Machines, Y. P. Chopra, ISBN:8120336453

3. Journal of Machine Design

EEEQ524 Energy Conservation and Management 48 hrs, 1.0 units

Purpose

The aim of this course is to enable the student to:

1. understand energy conservation
2. understand demand side management.

Learning Outcomes

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

1. explain energy conservation measures
2. explain concepts of demand side management.

Course Description

General energy problem: Global and national energy scenario, primary energy sources, energy use patterns, basic principles, laws of thermo dynamics, irreversibility, entropy, enthalpy, heat engine, refrigeration cycle, thermal efficiency and thermal exchange ratio. Critical and economical thickness of the insulation, optimum use of the prime movers for power generation, techniques of cogeneration technology, energy conservation methods in power

plants, conservation of energy in energy intensive industries. Maintenance engineering: Friction, lubrication and tribological innovations, predictive and preventive maintenance, energy audit. Heating, lighting, air conditioning of building and measures of conservation of electrical energy, energy conservation in domestic gadgets. Industrial heating and energy conservation in electric and oil fired furnaces. Measures for reduction of losses in the transmission and distribution systems. Energy efficient electric drives, energy efficient motors, VSD power factor improvement in power system. Energy conservation in transportation systems especially electric vehicle. Load curve analysis and load managements, DSM, energy storage for power systems (mechanical, thermal, electrical and magnetic), restructuring of electric tariff from energy conservation considerations, payback period.

Teaching Methodology: 2 hour lecture and 1 hour tutorial per week and at least three3-hour laboratory sessions per semester organized on a rotational basis

Instruction materials/equipment

1. Electrical Machines/ Installation Laboratory
2. Computer Laboratory
3. Projector

Prescribed text books

1. Barney L. Cape hart, Wayne C. Turner (2016), Guide to Energy Management,
Fairmont Press, ISBN: 1420084895

2. Clive Beggs (2002), Energy: Management, Supply and Conservation, Butterworth Heinemann, ISBN: 0750650966

References

1. Wayne C. Turner & Steve Doty (2012), Energy Management Handbook, 7th Ed., Fairmont Press, ISBN: 142008870X

2. Paul W. O'Callaghan (1993), Energy Management, McGraw-Hill Professional, ISBN: 0077076788

3. International Journal of Energy Conversion and Management

7.5.3.2 Telecommunication Systems Engineering Option

EEEQ525 Microwave Solid State Devices and Circuits 48 hrs, 1.0 units

Prerequisites

EEEQ451 Transmission Lines and Waveguides

Purpose

The aim of this course is to enable the student to;

1. understand microwave devices and systems and their applications in modern science and technology
2. understand RF, ultra-fast integrated circuits and optics

Learning Outcomes

At the end of this course, the student should be able to;

1. select suitable microwave devices for different tasks
2. apply the acquired knowledge and skills gained through laboratory practices and industrial attachment to design and construct and simple microwave components

Course Description

Microwave network analysis. Equivalent voltages and currents, impedance and admittance matrices, scattering matrix, the transmission matrix, signal flow graphs. Impedance matching and tuning, matching with lumped elements, single stub tuning, double-stub tuning, quarter wave transformer. Bipolar transistors biasing, FET – biasing, MESFET-structure, operation, high electron mobility transistors (HEMT), physical structure, operation, characteristics. Gunn effect, Ridley effect, Ridley-Watkins-Hilsum theory, Modes of operation, Limited space-charge accumulation (LSA) mode of Gunn diode, InP diodes. Microwave generation and amplification. Read diode, IMPATT diodes: structure, operation, power output and efficiency, TRAPATT diodes: operation, power output and efficiency, BARITT diodes: structure, operation. Parametric devices: parametric amplifiers. Monolithic microwave integrated circuit: materials, growth. MOSFET fabrication. Microwave filters: periodic structures, analysis of infinite periodic

structures and terminated periodic structures, filter design by image parameter method. Filter design by insertion loss method. Filter transformation and implementation. Microwave amplifiers and oscillators: amplifiers, gain and stability, single stage transistor amplifier design. Oscillator design: one-port negative resistance oscillators, transistor oscillators

Teaching Methodology

2 hour lectures and 1 hour tutorial per week, and at least five 3-hour laboratory sessions per semester organized on a rotational basis

Mode of course assessment:

Continuous assessment and written University examinations shall contribute 30% and 70%, respectively of the total marks.

Instructional Materials/Equipment

1. Telecommunication Lab
2. LCD projector

Course Textbooks

1. Mackintosh Consultants Company (1975), *Microwave Devices and Applications*,Mackintosh.
2. Simon Ramo, John R. Whinnery & Theodore Van Duzer (1984), *Fields and Waves in Communication Electronics*, John Wiley & Sons, 2nd Edition.

Course Journals

Reference Textbooks

1. Ahmad Shahid Khan, (2014) *Microwave Engineering: Concepts and Fundamentals*, CRC Press
2. Bradford L. Smith, Michel H. Carpentier (1993), *Microwave Engineering Handbook: Microwave circuits, antennas, and propagation*, Van Nostrand Reinhold, illustrated Ed.
3. David M. Pozar (2011), *Microwave Engineering*, Wiley International, 3rd Edition.

4. Annapurna Das (2010), *Microwave Engineering*, Tata McGraw-Hill.

Reference Journals

1. Radio Engineering
2. International Journal of Microwave Science and Technology
3. IEEE Microwave and Wireless Components Letters

EEEQ526 Integrated Optics and Photonic Systems 48 hrs, 1.0 units

Prerequisites

EEEQ226 Material Science

EEEQ234 Physical Electronics B

Purpose

The aim of this course is to enable the student to;

1. understand fundamentals of optical fibre
2. understand the concept of fibre optic systems

Learning Outcomes

At the end of this course, the student should be able to;

1. use fibre optic knowledge to design fibre optic systems
2. calculate and measure link budget in fibre optic systems

Course Description

Integrated photonics: history and characteristics, integrated photonics technology, basic integrated photonics components, IP devices. Integrated optic waveguides, optical waveguides, modes in planar waveguides, wave equation in planar waveguides, guided modes in step index planar waveguide and channel waveguides, Marcantile's method and reflective index method, graded index planar waveguides, multilayer and ray approximations, reconstruction of index profiles, inverse WKB method, modal coupling, coupled mode equations, co-directional and contra directional coupling, diffraction gratings in waveguides, coupling coefficients in

modulation index and relief diffraction gratings. Light propagation in wave guides; beam propagation method, paraxial propagation method, Fresnel equation, Fast Fourier transform method based on finite differences, boundary conditions, transparent boundary conditions, spatial frequency filtering, modal description based on BPM, modal field calculation using BPM.

Teaching Methodology

2 hour lectures and 1 hour tutorial per week, and at least five 3-hour laboratory sessions per semester organized on a rotational basis.

Mode of course assessment: Continuous assessment and written University examinations shall contribute 30% and 70%, respectively of the total marks.

Instructional Materials/Equipment

1. Electronics Lab
2. LCD projector

Course Textbooks

1. Enrico Forestieri (2005), *Optical communication theory and techniques*, Springer, illustrated ed.
2. M.M. Rao (2001), *Optical Communication*, Orient Blackswan, illustrated ed.

Course Journals

Reference Textbooks

1. John Gowar (1984), *Optical communication systems*, Prentice/Hall International, illustrated ed.
2. Biswanath Mukherjee (1997), *Optical Communication Networks*, McGraw-Hill, illustrated ed.

Reference Journals

1. Optical and Quantum Electronics
2. IEEE Journal on Selected Areas in Communications

3. Journal of Optical and Fiber Communications Reports

EEEQ527 Satellite and Mobile Communication Systems 48 hrs, 1.0 units

Prerequisites

Wireless Communications I

Purpose

The aim of this course is to enable the student to;

1. understand the differences between cellular telephone generations
2. know the ITU standards relevant to mobile communications
3. design cellular mobile telephone systems

Learning Outcomes

At the end of this course, the student should be able to;

1. Describe the characteristics of cellular telephone generations.
2. Describe the channelization methods used in cellular mobile communications
3. Perform traffic and link budget calculations for cellular telephone systems

Course Description

Kepler's law. Satellite orbits. Geostationary satellites. Antenna look angles. Satellite classification. Spacing and frequency allocation. Satellite antenna radiation patterns. Satellite system parameters. Satellite system link models. Link equations. Link budget. Satellite multiple access system. FDM/FM satellite systems. Multiple accessing. Channel capacity. Satellite radio navigation. Introduction to modern wireless communication systems: Second generation cellular networks. Third generation wireless networks. Wireless LANs. Personal area networks. The cellular concept: Frequency re-use. Hand-off strategies. Interference and system capacity. Improving coverage and capacity in cellular systems. Mobile Radio Propagation: Practical link budget design using path loss models. Outdoor and indoor propagation models. Fading and multipath channels and their parameters. Multiple Access Techniques for wireless

communications: FDMA, TDMA, SSMA, SDMA. Packet radio. Codes for mobile communication. Wireless systems and standards: GSM, CDMA digital (IS-95). Cordless systems. Wireless local loop. Mobile IP 386. Wireless Application Protocol. Bluetooth. Overview: Radio, baseband and link manager specifications. Logical link Control and adaptation protocol.

Teaching Methodology: 2 hour lectures and 1 hour tutorial per week and at least three 3-hour laboratory sessions per semester organized on a rotational basis.

Mode of course assessment:

Continuous assessment and written University examinations shall contribute 30% and 70%, respectively of the total marks.

Instructional Materials/Equipment

1. Telecommunications laboratory
2. LCD projector

Course Textbooks

1. Garg V.K. & Wilkes J. E. (2007), *Principles and Applications of GSM*, Pearson Education
2. Karim M.R. & Sarraf M. (2002), *W-CDMA and CDMA 2000*, McGraw Hill
3. Madhavendra Richharia,(2014) Mobile Satellite Communications: Principles and Trends,Wiley.
4. Roger Cochetti, (2014) Mobile Satellite Communications Handbook,Wiley.

Course Journals

1. **IEEE Transactions on Wireless Communications**

Reference Textbooks

1. Garg V.K. & Wilkes J.E, (1996), *Wireless and Personal Communications Systems*, Prentice Hall PTR
2. Schiller J. (2007), *Mobile Communications*, 2nd Ed, Pearson Education

Reference Journals

1. IEEE Transactions on Wireless Communications
2. EURASIP Journal on Wireless Communications and Networking
3. Mobile Networks and Applications
4. **Communications Engineering and Design Magazine**
5. IEEE Wireless Communications Magazine

EEEQ528 Spread Spectrum and CDMA 48 hrs, 1.0 units

Prerequisites

Signals and Communications I

Purpose

The aim of this course is to enable the student to;

1. understand the operation of A/D converters
2. appreciate the importance of wave shaping in digital communications
3. know the characteristics of various digital modulations schemes
4. understand the effects of noise in digital communications

Learning Outcomes

At the end of this course, the student should be able to;

1. describe the operation of A/D converters
2. Calculate bandwidth requirements in digital communications
3. Compute data transmission rates in the presence of noise

Course Description

Introduction to CDMA. Multiple access using spread spectrum. PN codes. Link analysis, shadowing, multipath Rayleigh fading, Multipath delay spread. System architectures, technologies and standards mainly for cellular applications. Wireless Local Loop. System dimension. Techniques used for capacity enhancements and their trade offs. Spread spectrum techniques. Direct Sequence and Frequency Hopped Spread Spectrum. Spreading sequences and their correlation functions. Their applications as access schemes. Performance in fading channels. Transmitter/ Receiver architectures design option. Role of different diversity techniques. Effect of imperfect power control on DS-CDMA performance. Spreading/Coding

trade offs. Multi-carrier CDMA, IS-95A CDMA system. Third generation CDMA systems. Multi-user Detection – Optimum receiver, MMSE.

Teaching Methodology: 2 hour lectures and 1 hour tutorial per week and at least three 3- hour laboratory sessions per semester organized on a rotational basis.

Mode of course assessment: Continuous assessment and written University examinations shall contribute 30% and 70%, respectively of the total marks.

Instructional Materials/Equipment

1. Telecommunications laboratory
2. LCD projector

Course Textbooks

1. Ali Grami,(2015) Introduction to Digital Communications,Academic Press.
2. Mehmet Safak (2017), *Digital Communications*, Wiley.
3. Shanmugam K.S. (2004), Digital and Analog Communication Systems, John Wiley and Sons (Asia)

Course Journals

Reference Textbooks

1. Ziemer and Tranter (2014*), Principles of Communications,*Wiley.
2. Steve Reich, Phililp Glass, (2016)*Information Transmission, Modulation and Noise*.

Reference Journals

1. IEEE Transactions in Communications
2. Journal of Communications Network

7.5.3.3 Instrumentation and Control Engineering Option

EEEQ529 Distributed Control Systems 48 hrs, 1.0 units

Prerequisites:

Control Engineering

Database systems

Network security and cryptography

Purpose

The aim of this course is to equip the student with knowledge and skills of distributed control systems

Learning Outcomes

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

1. Setup a practical distributed control system
2. Setup databases and communication systems for a practical distributed control system

Course Outline

Distributed Control system (DCS) components; DCS features, networks in DCS, redundancy, DCS I/O requirements and circuitry, loop diagrams, design of DCS grounding system. DCS programming; languages, control system hierarchy, function block safety, DCS software configuration for feedback, cascade, feed forward, hybrid control systems, Execution rate. Foundation field bus; network architecture, functions of field bus layers, link active scheduler, messages, use of function block location. Logic system types; interlocks and sequence control, features. The characteristics and objectives of distributed systems. Distribution of data, management, control; maintenance and administration. Network support requirements. Network owners vs network users. Processors and processes. Process communication and resource sharing. Communication primitives. Application oriented services. Virtual processors, virtual file service, virtual terminal service, job transfer, their design and implementation. Networked computer applications support, synchronization issues such as global state, election, inter-process communication, distributed mutual exclusion, distributed transaction mechanisms. Consistency models and protocols and replication. Fault tolerance and cryptographic security. Fault models, reliable multicast, commit, check-pointing, recovery, access control.

Teaching Methodology:

2 hour lectures and 1 hour tutorial per week and 3 hour laboratory sessions per week organized on a rotational basis

Mode of Examination:

Continuous Assessment and Written University Examination shall contribute 30% and 70% respectively of the total marks.

Instructional Materials/Equipment:

1. Computer Lab
2. Overhead projector

Prescribed text books

1. John McBrewster, Frederic P. Miller, Agnes F. Vandome (2010) "Distributed Control System"
2. Lonnie R. Welch, Dieter K. Hammer (2009), "Engineering of distributed control systems"

References

1. Astrom, K.J., Wittenmark, B. (1996). "Computer-Controlled Systems" ,3rd Edition, Prentice Hall
2. Buttazzo, G. (2005), "Hard real-time computing systems", Second Edition, Springer

EEEQ530 Pneumatics and Hydraulic Systems 48 hrs, 1.0 units

Prerequisites:

Purpose

The aim of this course is to enable the student to:

1. Lean concepts of pneumatics and hydraulic systems
2. Get designing skills on pneumatics and hydraulic systems

3.Work on diagnosis ,maintenance and repair of pneumatics and hydraulic systems

Learning Outcomes

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

1. Identify and describe operation of components in pneumatics and hydraulic systems
2. Size components and incorporate them in both pneumatics and hydraulic systems
3. Diagnose, identify faults, repair and maintain pneumatics and hydraulic systems

Course Outline

Pneumatics**:** air compressors, reciprocating and rotary compressors. Air receivers, air filters, pressure regulators, lubricators and driers. Pneumatic valves: check valve flow; control valve, directional control valve. Linear and rotary actuators, actuator packings. Pneumatic circuits and pneumatic line calculations. Hydraulics**:** hydraulic pumps, gear pumps, axial pumps, centrifugal pumps, vane pumps and piston pumps. Hydraulic actuator, linear and rotary actuators, actuator packings. Control valves: directional control, flow control, and pressure control. Hydraulic power packs. Pneumatic line calculations. Networks, Madaline network, mean square error, LMS algorithm, back propagation algorithms and neural networks, Hopfield networks. Adaptive filtering: adaptive noise cancellation, forecasting, neural control applications, character recognition. Performance learning: quadratic functions-performance optimization-steepest descent algorithm, learning rates, Widrow-Hoff learning - ADALINE networks, LMS algorithm, linear separability. The XOR problem, Multilayer Perceptrons (MLPs).

Teaching Methodology: 2 hour lectures and 1 hour tutorial per week and 3 hour laboratory (The unit covers both pneumatics and hydraulics which are essentially two units in one. Two lecture hours are insufficient and I recommend at least THREE hours per week)sessions per week organized on a rotational basis

Mode of Examination:

Continuous Assessment and Written University Examination shall contribute 30% and 70% respectively of the total marks.

Instruction materials/equipment

1. Hydraulic/ Pneumatics trainer

2. Simulation soft ware

Prescribed text books

1. Basic principles and components of fluid technology by H. Exner 1991
2. T. Jagadeesha, (2015) Hydraulics and Pneumatics, I.K. International Publishing House.
3. Andraw A. Parr (2011) Hyraulics and pneumatics, Butterworth-Heinemann.

References

1. Pneumatic Principles by Peter Crose and Frank Abel 2002

2. M. Winston,(2014) Essential Hydraulics: Fluid Power,CreateSpace Independent Publishing Platform.

3.Journals in fluid power Engineering

EEEQ531 Environmental Instrumentation 48 hrs, 1.0 units

Purpose

The aim of this course is to enable the student to:

1. understand the generalised performance of instrumentation systems

2. understand the use of actuators and transducers in environmental instrumentation systems

Learning Outcomes

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

1. explain the structure and operation of environmental instrumentation systems such as radiation and pollution detectors

2. explain the Characteristics of waste and sources of pollution

3. explain control instrumentation of specific industrial pollution

Course Description

Introduction, Radiation detectors, Nuclear reactor instrumentation, radioactive tracer techniques, Thickness and density measurement, level detection spectroscopic analysis, safety. Characteristics of waste and sources of pollution, Air & water pollution, Instrumentation, Land pollution, Instrumentation for noise and thermal pollution monitoring, control instrumentation of specific industrial pollution, meteorology.

Teaching Methodology:

2 hour lectures and 1 hour tutorial per week and 3 hour laboratory sessions per week organized on a rotational basis

Mode of Examination:

Continuous Assessment and Written University Examination shall contribute 30% and 70% respectively of the total marks.

Instruction materials/equipment

1. Control Engineering Laboratory
2. Electronics Laboratory
3. Projector

Prescribed text books

4. A. K. Sawhney (2007), A Course in Electrical and Electronic Measurement and Instrumentation, 17th Ed., Dhanpat Rai & Co. (p) Ltd.
5. J.B. Gupta,(2006), A Course In Electronics & Electrical Measurements And Instrumentation, S. K. Kataria & Sons.
6. Francis S. Tse, Ivan E. Morse (1989), Measurement and Instrumentation in Engineering: Principles and Basic Laboratory Experiments, CRC Press.

References

1. Alan S. Morris (2005), Measurement & Instrumentation Principles, Elsevier India Private Limited, ISBN: 8131202666

2. J. B. Gupta (2006), A Course in Electronics and Electrical Measurements and Instrumentation, S. K. Kataria & Sons, ISBN: 8188458937

3.Journal of Instrumentation

EEEQ532 Digital Control Engineering 48 hrs, 1.0 units

Prerequisites:

Control Engineering

Database systems

Network security and cryptography

Purpose

The aim of this course is to equip the student with knowledge and skills of distributed control systems

Learning Outcomes

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

1. Setup a practical distributed control system
2. Setup databases and communication systems for a practical distributed control system

Course Outline

Sampling process, impulse modulation, z-transform mapping of j plane to z plane, pulse transfer function stability and analysis in z plane. Discrete time signals and systems- SDC systems, sampling and data reconstruction, discrete time state (difference) equations and solution. Transform analysis of discrete systems;- linear differential equations, pulse transfer function and pulse response, z-transform, equivalent of z- domain to s domain. Design of digital controls- position servomechanism, digital PID controller, multivariable controllers, digital and logic gates. Functions- arithmetic functions skip and master control, data none system, digital bits, sequence functions, matrix functions, robot control, FIFO, LIFO and loop control. Process variables, mathematical modelling of liquid, gas, thermal, mechanical and chemical systems, linearizing techniques, liquid level control- a tank, dynamics of manometer, response of non-interacting and interacting first order elements in series. On-off, proportional, integral, and

derivative modes; - Electronic pneumatic and hydraulic controllers, single and composite modes of controllers. Control valves; -types, functions, electrical pneumatic, hydraulic actuators, solenoid E. P converters. Simple loop, multi loop systems P/I, cascade ration feed forward, override split range, selective and auctioneering control system with multiple loops, dead time compensation, and adaptive, inferential control. Design of control systems for multivariable processes. Computer control systems in process control- DCS configuration, consul, DCS I/O hardware supervisory and data acquisition systems. Optical links; - optical radiation sources, optical detectors, typical systems.

Teaching Methodology:

2 hour lectures and 1 hour tutorial per week and 3 hour laboratory sessions per week organized on a rotational basis

Mode of Examination:

Continuous Assessment and Written University Examination shall contribute 30% and 70% respectively of the total marks.

Instructional Materials/Equipment:

1. Computer Lab
2. Overhead projector

Prescribed text books

1. John McBrewster, Frederic P. Miller, Agnes F. Vandome (2010) “Distributed Control System”
2. Lonnie R. Welch, Dieter K. Hammer (2009), “Engineering of distributed control systems”

References

1. Astrom, K.J., Wittenmark, B. (1996). “Computer-Controlled Systems” ,3rd Edition, Prentice Hall
2. Buttazzo, G. (2005), “Hard real-time computing systems”, Second Edition, Springer

7.5.3.4 Electronic and computer engineering

EEEQ533 Digital Transmission 48 hrs, 1.0 units

Prerequisites: Digital Communication Systems

- Introduction to communication systems.
- Information theory.
- Theory of electric circuit and signals (electric circuit design).
- Digital modulation and coding techniques.

Purpose

The aim of this course is to enable the student to:

1. Design sophisticated communication systems.
2. Be able to diagnose and rectify faults in a digital communication channel(s).
3. Be able to represent digital signals in a proper format for transmission.
4. Code and decode both analogue and digital signals.
5. Be able to select the best medium for various transmission scenarios.

Learning Outcomes

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

1. Implement various transmission systems.
2. Select the best transmission systems and media.
3. Choose the best line codes and coding techniques for digital transmission.

Course Description

Representation of bandpass signals and systems, representation of digitally modulated signals, spectral characteristics of digitally modulated signals. Detection of signals, Estimation: concept and criteria, maximum likely hood estimation, linear prediction, predictive vocoders, steepest descent algorithm, least mean square algorithm. Speech coding, picture coding. Digital signalling over fading multipath channels, diversity techniques, coded waveforms for fading channels, linear equalization, Decision Feedback Equalization (DEF), Multilevel signalling. Optical fibre communication, optical fibre sources and detectors, optical coherent systems.

Principle of digital switching, time division switching, space division switching, switching network, SPC processor, T-S-T network, S-T-S network, traffic analysis and switch design, large scale electronics switching system.

Teaching Methodology:

2 hour lectures and 1 hour tutorial per week, 2hour laboratory sessions after every two weeks organized on a rotational basis and take away assignments.

Mode of Examination:

Continuous Assessment and Written University Examination shall contribute 30% and 70% respectively of the total marks.

Instruction materials/equipment

LCD projectors, lecture handouts, white boards and marker pens.

Prescribed text books

1. Lebow, Understanding Digital Transmission and Recording (Piscataway, NJ: IEEE Press,1998)

References

1. Madhow, U. Fundamentals of digital communication. New York, USA: Cambridge university press , 2008.
2. Lathi, B. P. An introduction to Random signals and Communication Theory. Scramton, Pennsylvania, USA: International Textbook Company, 1968.
3. Ziemer, R.E. and Peterson, R. L. Introduction to Digital Transmission. Upper Saddle River, New Jersey, USA: Prentice-Hall, 2001.
4. Special Issue on Communications in the 21st Century, Proc. IEEE, Vol. 85, Oct. 1997.

EEEQ534 Distributed Control Systems 48 hrs, 1.0 units

Prerequisites:

Control Engineering

Database systems

Network security and cryptography

Purpose

The aim of this course is to equip the student with knowledge and skills of distributed control systems

Learning Outcomes

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

1. Setup a practical distributed control system
2. Setup databases and communication systems for a practical distributed control system

Course Outline

Distributed Control system (DCS) components; DCS features, networks in DCS, redundancy, DCS I/O requirements and circuitry, loop diagrams, design of DCS grounding system. DCS programming; languages, control system hierarchy, function block safety, DCS software configuration for feedback, cascade, feed forward, hybrid control systems, Execution rate. Foundation field bus; network architecture, functions of field bus layers, link active scheduler, messages, use of function block location. Logic system types; interlocks and sequence control, features. The characteristics and objectives of distributed systems. Distribution of data, management, control; maintenance and administration. Network support requirements. Network owners vs network users. Processors and processes. Process communication and resource sharing. Communication primitives. Application oriented services. Virtual processors, virtual file service, virtual terminal service, job transfer, their design and implementation. Networked computer applications support, synchronization issues such as global state, election, inter-process communication, distributed mutual exclusion, distributed transaction mechanisms. Consistency models and protocols and replication. Fault tolerance and cryptographic security. Fault models, reliable multicast, commit, check-pointing, recovery, access control.

Teaching Methodology: 2 hour lectures and 1 hour tutorial per week and 3 hour laboratory sessions per week organized on a rotational basis

Mode of Examination:

Continuous Assessment and Written University Examination shall contribute 30% and 70% respectively of the total marks.

Instructional Materials/Equipment:

1. Computer Lab
2. Overhead projector

Prescribed text books

1. John McBrewster, Frederic P. Miller, Agnes F. Vandome (2010) "Distributed Control System"
2. Lonnie R. Welch, Dieter K. Hammer (2009), "Engineering of distributed control systems"
3. Moustafa Elshafei,(2016), Modern Distributed Control Systems: A comprehensive coverage of DCS technologies and standards,CreateSpace Independent Publishing Platform.

References

1. Astrom, K.J., Wittenmark, B. (1996). "Computer-Controlled Systems" ,3rd Edition, Prentice Hall
2. Buttazzo, G. (2013), "Hard real-time computing systems", Springer.

EEEQ535 Mobile Computing 48 hrs, 1.0 units

Prerequisites:

Information security.

Data base Management.

Mobile Wireless communications (Networks).

Programming languages and internet computing technologies.

Purpose

The aim of this course is to enable the student to:

1. Address various mobility challenges.

2. Gain understanding of Location management.
3. Configure and pair various wireless devices for communication purposes.
4. Develop simple applications supported by both computer and phone operating systems.
5. Prepare for further application development.
6. The course offers detailed discussion of the important and challenging issues in mobile computing and examines the different approaches that address these issue

Learning Outcomes

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

1. Address mobility issues through implementation of wireless communication networks.
2. Address minor issues related to mobility through implementation of networking interfaces.
3. Understand challenging issues in mobile computing and examines the different approaches that address these issues.

Course Description

Issues in mobile computing, overview of wireless telephony, IEEE 802.11 and Blue Tooth, wireless multiple access protocols, channel Allocation in cellular systems. Data management issues, data replication for mobile computers, adaptive clustering for mobile wireless networks. Distributed location management, pointer forwarding strategies, energy efficient indexing on air, energy indexing for wireless broadcast data, mobile IP, TCP over wireless. Mobile agents computing, security and fault tolerance, transaction processing in mobile computing environment. Ad hoc network, routing protocol, Global State Routing (GSR), Dynamic State Routing (DSR), Fisheye State Routing (FSR), Ad hoc On-Demand Distance Vector (AODV), Destination Sequenced Distance – Vector Routing (DSDV).

Teaching Methodology: 2 hour lectures and 1 hour tutorial per week, 2hour laboratory sessions after every two weeks organized on a rotational basis and take away assignments.

Mode of Examination

Continuous Assessment and Written University Examination shall contribute 30% and 70% respectively of the total marks.

Instruction materials/equipment

Laboratory work/ experiments.

LCD projectors.

White boards and marker pens.

Prescribed text books

1. Prasant KumarPattnaik, Rajib Mall (2015), Fundamentals of Mobile Computing,PHI Learning.
2. M.M.Rajhashyamala, N.Tajunisha (2016), Handbook on Mobile Computing and Its Applications

References

1. Koushik Sinha, Sasthi C. Ghosh, Bhabani P. Sinha,(2015), Wireless Networks and Mobile Computing,Chapman and Hall/CRC.
2. Ad Hoc Networking, Charles Perkins, Addison Wesley, 2001.
3. Imad Mahgoub and Mohammad(2016),Smart Dust: Sensor Network Applications, Architecture and Design.

EEEQ536 Artificial Intelligence and Expert Systems 48 hrs, 1.0 units

Prerequisites

None

Purpose

The aim of this course is to enable the student to;

1. understand the fundamentals and types of Knowledge Based Systems
2. understand the use of fuzzy logic and neural networks

Learning Outcomes

At the end of this course, the student should be able to;

1. use fuzzy logic and neural networks in design of systems
2. artificial intelligence in design telecommunication systems

Course Description

The module introduces the student to techniques used in Artificial Intelligence including problem formulation, search, logic, probability and decision theory. The module aims to provide the participants with a basic knowledge of artificial intelligence; an understanding of how to design an intelligent agent; and knowledge of basic AI tools. Topic covered include: Introduction to AI and Intelligent Agents. Problem solving and search. Logical agents . First order logic. Building a knowledge base. Inference in first order logic. Probability and decision theory. Definition – history and applications – propositional calculus – predicate calculus – inference rules – structures and strategies for state space search – heuristic search algorithms – heuristics in games – complexity issues – control and implementation of state space search – production systems – planning – the blackboard architecture Introduction to understanding natural language – introduction to automated reasoning – introduction to machine learning. Knowledge intensive problem solving – expert system technology – rule-based expert systems – model based reasoning – case based reasoning – knowledge representation problem reasoning with uncertain or incomplete information – statistical approach – non-monotonic systems – fuzzy sets – knowledge representation – languages – issues – network representation – conceptual graphs – structured representation.

Teaching Methodology

2 hour lectures and 1 hour tutorial per week, and at least five 3-hour laboratory sessions per semester organized on a rotational basis.

Mode of course assessment:

Continuous assessment and written University examinations shall contribute 30% and 70%, respectively of the total marks.

Instructional Materials/Equipment

1. Computer Lab

2. LCD projector

Course Textbooks

1. Stuart Jonathan Russell, Peter Norvig and John F. Canny (2015), *Artificial Intelligence: A Modern Approach*,Prentice Hall.
2. Jerry Kaplan (2016), *Artificial Intelligence: What Everyone Needs to Know*, Oxford University Press.

Course Journals

Reference Textbooks

1. Jon Gabriel, (2016) Artificial Intelligence: Artificial Intelligence for Humans (Artificial Intelligence, Machine learning), Amazon Digital Services LLC.
2. B. George, Gail Carmichael, Susan S Mathai, Andrew Carmichael (2016),*Artficial Intelligence Simplified: Understanding Basic Concepts*, CS Trends LLP.
3. Dr. B. George, Gail Carmichael, Susan S Mathai, Andrew Carmichael (2016), *The Essence of Artificial Intelligence*, CSTrends LLP.

Reference Journals

1. International Journal of Knowledge-Based and Intelligent Engineering Systems
2. Artificial Intelligence
3. Applied Soft Computing
4. Advances in Fuzzy Systems
5. Engineering Intelligent Systems
6. Engineering Applications of Artificial Intelligence