BAUET

Syllabus for
Bachelor of Science in

Electrical and Electronic Engineering

EEE

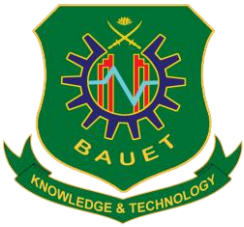


Bangladesh Army University of Engineering & Technology
Qadirabad, Natore

EEE Session 2019-20

2nd Edition

Bangladesh Army University of Engineering and Technology (BAUET)
Qadirabad, Natore



Department of
Electrical and Electronic Engineering (EEE)

Syllabus for
Bachelor of Science (B.Sc.) in
Electrical and Electronic Engineering (EEE)

Applicable for Session 2019-20 and onward

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Disclaimer:

The information of this syllabus intends to provide guidance to those who are concerned with undergraduate studies in the Department of Electrical and Electronic Engineering. The Department of Electrical and Electronic Engineering or Bangladesh Army University of Engineering & Technology will carry no responsibility, if any inconvenience or expenditure is caused to any person because of the information of this booklet or any error in quoting the rules and regulations described herein. In addition, the information contained in it, are subjected to change at any time without any prior notification.

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Preface to Second Edition

Bangladesh Army University of Engineering & Technology (BAUET) is one of the premier universities in the country now and has a bright prospect for its high standards in teaching and research. Ever since its inception, a strong commitment to excellence in teaching and research has been its main concentration.

Our previous departmental syllabus was published in 2015. Four years had been passed. In these years, Electrical and Electronic Engineering technologies have advanced rapidly. A significant change on the curriculum focusing Outcome Based Education (OBE) has become a fundamental demand by Board of Accreditation for Engineering and Technical Education (BAETE), Bangladesh. These new changes require a revised, vivid and dynamic look to our previous syllabus both in academic course outline and in the academic ordinance.

The Department of Electrical and Electronic Engineering (EEE) is one of the largest departments of the Bangladesh Army University of Engineering and Technology (BAUET). The department has run from the starting of this university with the aim of producing the best engineers, teachers, and professionals for the national and international arena. To cope with the rapidly changing scenarios in this field, updating the course curricula, expanding laboratory facilities and revising teaching and/or research materials are regular activities of the EEE department. The department constantly tries to revise, renew and introduce courses so that our students remain in balance with students of other standard universities in the world. The undergraduate syllabus presented in this course calendar is part of this ongoing change to meet the needs of present EEE students so that they can meet their carrier requirements in national and international forums.

The syllabus and the course offering listed in this catalog are prepared by teachers of the department with the help, cooperation and feedback from some renowned faculties. Students can now choose their field of specialization from any of the four fields, i.e. Communication, power, electronics and computer, without sacrificing the fundamental and basic study of core courses of electrical and electronic engineering. As a result of this and other major changes in course contents, the laboratory materials have also changed with more design-oriented classes having an emphasis on both practical and simulation components. The department has developed many facilities for such changes to be incorporated effectively and effort is also underway to improve the situation further.

Students and relevant individuals are advised to be in touch with their advisors and the department office to learn about any changes made by the department in any courses and in the rules and regulations of the university.

Head,
Department of Electrical and Electronic Engineering,
Bangladesh Army University of Engineering and Technology.

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Chapter 1

General Information

1.1 About BAUET

Bangladesh Army University of Engineering & Technology, abbreviated as BAUET, started its journey on 15 January 2015. It was an outcome of the visionary leadership of the Honorable Prime Minister of the People's Republic of Bangladesh who planned to establish technical universities to be run by the army. The university campus is located near at Qadirabad Cantonment, Natore. All academic programs, courses and syllabus of BAUET are approved by the UGC. All academic programs and examinations are conducted as per the schedule approved by the University.

1.2 About EEE

The Department of Electrical and Electronic Engineering (EEE) is one of the largest departments of BAUET. The department has run from the starting of this university with the aim of producing the best engineers, teachers, and professionals for the national and international arena. To cope with the rapidly changing scenarios in this field, updating the course curricula, expanding laboratory facilities and revising teaching and/or research materials are regular activities of the EEE department. The department constantly tries to revise, renew and introduce courses so that our students remain in balance with students of other standard universities in the world.

1.3 Vision and Missions

Vision of BAUET
To create a platform of knowledge of excellence for providing quality education in engineering, science and general education to meet the national and global challenges.

Missions of BAUET

- To provide comprehensive education and conduct research in diverse disciplines of science, engineering, technology and engineering management.
- To produce technologically advanced intellectual leaders and professionals with high moral and ethical values to meet the socio- economic development of Bangladesh and global needs.
- To conduct collaborative and research activities with national and international communities for continuous interaction with academia and industry.
- To provide consultancy, advisory and testing services to government, nongovernment, autonomous and individuals for widening practical knowledge and to contribute in sustainable development.

Vision of EEE
To create skilled and competent professionals in the field of Electrical and Electronic Engineering with high morals to meet the national and global needs through creative research and innovations.

Missions of EEE

- To provide high-quality state of the art education and knowledge in Electrical and Electronic Engineering to produce competent engineers, capable of solving real-world problems to meet the needs of industry and society.
- To contribute towards the creation of new knowledge through eminence research and innovation in EEE and allied fields to address emerging national and global issues for the well-being of the society.
- To enable students in attaining the required ethics with an attitude of entrepreneurial skills, ethical values and social consciences.
- To embed leadership qualities amongst the students to follow successful professional career paths and to pursue advanced studies in electrical engineering and a lifelong learner in cutting edge developments in the field of power system.

1.4 Faculties, Departments and Degree Awarded

Faculty Name	Department Name	Degree Awarded
Electrical and Computer Engineering	Electrical and Electronic Engineering	B.Sc. in EEE
	Computer Science and Engineering	B.Sc. in CSE
	Information and Communication Engineering	B.Sc. in ICE
Civil and Environmental Engineering	Civil Engineering	B.Sc. in CE
Mechanical Engineering	Mechanical Engineering	B.Sc. in ME
Business	Business Administration	BBA
Law and Justice	Law	LLB
Science and Humanities	English	BA (Hons.) in ELL
	Physics	-
	Chemistry	-
	Mathematics	-
	Sociology	-

1.5 Laboratory Facilities on EEE

BAUET has 13 well-equipped laboratories under the EEE department to support all its' courses.

Sl. no.	Name of the laboratories
1.	Electrical Circuits Lab
2.	Electrical Machine Lab
3.	Electronics Circuit Lab
4.	Measurement Lab
5.	Simulation Lab
6.	Very Large Scale Integration (VLSI) Lab
7.	Digital Signal Processing (DSP) Lab
8.	Electrical & Electronic Workshop and Automation Lab
9.	Power System Lab
10.	HVDC Lab
11.	Control System Lab
12.	Power Electronics Lab
13.	Green Energy Lab

1.6 Research Activities on EEE

The research work undertaken by the teachers and students of this department in the last few years is diversified in nature. The faculty members have a good number of publications in different national and international conferences and journals. BAUET also regularly publishes an annual technical journal where faculties and students of EEE department put their contributions.

1.7 Co-curricular activities

BAUET has certain policy regarding students' co-curricular activities. These activities are encouraged and also supported by all means from Directorate of Student Welfare. Throughout the academic calendar, different types of co-curricular activities and competition inside and even also outside the country are arranged in regular basis. There are also different types of club activities which are conducted by different departments. For example:

- BAUET Programming Club
- BAUET Automation and Robotic Club (BARC)
- Career Club
- Photography Club
- Cultural Club
- English Language Club
- BAUET Welfare Club
- BAUET Sports Club
- Debate Club
- Prothom Alo *Bundhu shova*-BAUET

Chapter 2

Curriculum Focusing Outcome Based Education (OBE)

The department of Electrical and Electronic Engineering of BAUET has started to implement the curriculum focusing Outcome Based Education (OBE). OBE is an educational process that is forced at achieving certain specified outcomes for graduate students. It focuses on how much and how well the students have learned and what students can actually be capable after they are taught. Engineering students are expected to be able to do more challenging tasks other than memorizing and reproduce.

The desired outcome is selected first and the curriculum, instructional materials assessments and evaluations like examinations, tests, quizzes, assignments, mini projects, case studies, grading etc. are created to support and achieve the intended outcome.

2.1 Program Educational Objectives (PEOs):

No	PEO Statement
PEO-1	Graduates will be able to contribute in the educational, cultural, social, technological and economic development of society through the high level of professional and ethical values
PEO-2	Graduates will provide effective solutions to the complex engineering problems related to power system and communication by analyzing, designing and optimizing modern technologies
PEO-3	Graduates will be able to establish and run sustainable business enterprises along diverse career paths by creating, selecting, applying appropriate and modern technologies, skills and tools
PEO-4	Graduates of the program will have successful professional both in industry and government and/or will be able to successfully pursue advanced degrees

2.2 PEO and Mission Mapping:

PEO No.	PEO statement	University mission statements			
		Mission statement 1	Mission statement 2	Mission statement 3	Mission statement 4
Graduates of the Electrical and Electronic Engineering program are expected to attain or achieve the following Program Educational Objectives within a few years of graduation:					
1	Graduates will be able to contribute in the educational, cultural, social, technological and economic development of society through the high level of professional and ethical values	High	-	-	Low
2	Graduates will provide effective solutions to the complex engineering problems related to power system and communication by analyzing, designing and optimizing modern technologies	Low	-	High	-
3	Graduates will be able to establish and run sustainable business enterprises along diverse career paths by creating,	-	Low	-	High

	selecting, applying appropriate and modern technologies, skills and tools				
4	Graduates of the program will have successful professional both in industry and government and/or will be able to successfully pursue advanced degrees	-	High	-	Low

2.3 Program Outcomes (PO) Statement

Based on the suggestion of the Board of Accreditation for Engineering and Technical Education (BAETE), Bangladesh, the Bachelor in Electrical, Electronics and Communication Engineering (EECE) program will have following learning outcomes:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research the literature and analyze complex engineering problems and reach substantiated conclusions using first principles of mathematics, the natural sciences and the engineering sciences.
3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety as well as cultural, societal and environmental concerns.
4. **Investigation:** Conduct investigations of complex problems, considering design of experiments, analysis and interpretation of data and synthesis of information to provide valid conclusions.
5. **Modern tool usage:** Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice.
7. **Environment and sustainability:** Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of, for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics, responsibilities and the norms of the engineering practice.
9. **Individual work and teamwork:** Function effectively as an individual and as a member or leader of diverse teams as well as in multidisciplinary settings.
10. **Communication:** Communicate effectively about complex engineering activities with the engineering community and with society at large. Be able to comprehend and write effective reports, design documentation, make effective presentations and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work as a member or a leader of a team to manage projects in multi-disciplinary environments.

12. **Life-long learning:** Recognize the need for and have the preparation and ability to engage in independent, life-long learning in the broadest context of technological change.

2.4 Program Outcome (PO) statements and their mapping with the PEOs:

PO	PO statement	PEO 1	PEO 2	PEO 3	PEO 4
a	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems	Low	High	Low	Low
b	**Problem analysis:** Identify, formulate, research and analyze complex engineering problems and reach substantiated conclusions using the principles of mathematics, the natural sciences and the engineering sciences	-	High	Low	-
c	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety and of cultural, societal and environmental concerns	-	High	Low	-
d	**Investigation:** Conduct investigations of complex problems, considering experimental design, data analysis and interpretation and information synthesis to provide valid conclusions	-	-	-	High
e	**Modern tool usage:** Create, select and apply appropriate techniques, resources and modern engineering and IT tools, including prediction and modeling, to complex engineering activities with an understanding of their limitations	-	-	High	-
f	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice.	High	-	-	Low
g	**Environment and sustainability:** Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.	High	-	-	-
h	**Ethics:** Apply ethical principles and commit to the professional ethics, responsibilities and the norms of the engineering practice.	-	-	Low	High
i	**Individual work and teamwork:** Function effectively as an individual and as a member or leader of diverse teams and in multidisciplinary settings.	-	-	High	-
j	**Communication:** Communicate effectively about complex engineering activities with the engineering community and with society at large. Be able to comprehend and write effective reports, design documentation, make effective presentations and	Low	-	-	High

	give and receive clear instructions.				
k	**Project management and finance:** Demonstrate knowledge and understanding of engineering and management principles and apply these to one's work as a team member or a leader to manage projects in multidisciplinary environments.	-	-	High	-
l	**Life-long learning:** Recognize the need for and have the preparation and ability to engage in independent, life-long learning in the broadest context of technological change.	High	-	Low	-

Chapter 3

Rules and Regulations for Undergraduate Program

3.1 Introduction

The rules and regulations mentioned in this chapter will be applicable to the students for administering the undergraduate curriculum through the academic year. This will be introduced with the aim of creating a continuous, even and consistent workload throughout the semester for the students. Here, the degree name, registration procedure, grading system, mark distribution, examination related policies etc. are describe shortly.

3.2 Degree Offered

The department offers a degree named
"***Bachelor of Science in Electrical and Electronic Engineering"***.

3.3 Admission Eligibility

3.3.1 SSC/Dakhil and HSC/Alim Examinations: HSC/Alim or equivalent examination in Science Group with Mathematics, Physics and Chemistry scoring minimum GPA 3.0 for each. The sum total GPA of SSC/Dakhil and HSC/Alim should be minimum 7.0 (with additional subject).

3.3.2 GCE Applicants

a. O Level: Minimum C Grade in five subjects including, Mathematics, Physics and Chemistry (in the scale of A=5, B=4, C=3, D=2 and E=1)
b. A Level: Minimum C Grade in 2 subjects including Mathematics, Physics/Chemistry.
c. The sum total of GOA in GCE A and O level should be 6.
d. The candidates with E grade in any subject will not be considered.

3.4 Number of Semesters in a Year

There will be two semesters in an academic year.

a. Semester I (Summer)
b. Semester II (Fall)

3.5 Duration of Semesters

3.5.1 Semesters and Duration: There will be two Semesters: Semester I and Semester II. Semester I will be of 24 weeks and Semester II will be of 28 weeks (Total 52 weeks). An Academic Calendar will be provided to all the enrolled students to make them familiar to all academic events. The holiday will also be included in the calendar.

3.5.2 Annual Semesters Plan: Duration of Semester I and Semester II will be as follows:

Semester I:

Sl.	Events	Durations
1.	Classes before Mid Semester	7 weeks
2.	Mid Semester Break	1 week
3.	Classes after Mid Semester	7 weeks
4.	Lab Test Week	1 week
5.	Preparatory Leave	2 weeks
6.	Semester Final Examination	3 weeks
7.	Result Publication and Semester End Vacation	3 weeks
Total		**24 weeks**

Semester II:

Sl.	Events	Durations
1.	Classes before Mid Semester	7 weeks
2.	Mid Semester Break	1 week
3.	Classes after Mid Semester	7 weeks
4.	Lab Test Week	1 week
5.	Preparatory Leave	2 weeks
6.	Semester Final Examination	3 weeks
7.	Result Publication and Semester End Vacation	3 weeks
8.	Industrial Training and Survey Practical	4 weeks
Total		**28 weeks**

Note: Those who will not be able to clear any of the courses (only theoretical) of any discipline in a particular Semester (Semester I and Semester II) will be required to appear at the referred examination (Re-examination) for fulfilling the condition as per policy to clear the subject(s).

3.6 Course Pattern and Credit Structure

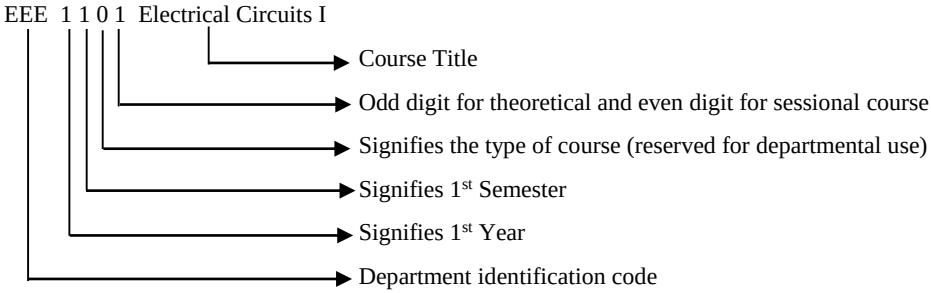
The undergraduate program is covered by a set of theoretical courses along with a set of sessional courses to support them.

3.6.1 Course Designation System

Each course is designated by a maximum of four letter code identifying the department offering the course followed by a four-digit number having the following interpretation

a. The first digit corresponds to the year in which the course is normally taken by the students.
b. The second digit corresponds to the semester.
c. The third digit is reserved for the departmental use. It manually identifies a specific area/group of study within the department.
d. The last digit is an odd number for theoretical courses and even numbers for sessional courses.

The course designation system is illustrated as follows



3.6.2 Assignment of Credits

The assignment of credits to a theoretical course follows a different rule from that of a sessional course.

a. Theoretical Courses: One lecture per week per semester is equivalent to one credit.
b. Sessional Courses: Credits for sessional courses is half of the class hours per week per semester.

Credits are also assigned to project and thesis work taken by the students. The amount of credits assigned to such work varies from one discipline to another.

3.6.3 Types of Courses

The type of courses included in the undergraduate curriculum are divided into the following groups

a. **Core Courses:** In each discipline, a number of courses are identified as core courses, which form the nucleus of the respective bachelor's degree program. A student has to complete all the designated core courses of his/her discipline.
b. **Prerequisite Courses**: A prerequisite course is one which is required to be completed before starting a new course.
c. **Optional Courses:** Apart from the core courses, the students can choose from a set of optional courses. A required number of optional courses from a specified group have to be chosen.
d. **Integrated Design Project (IDP)/Capstone Project and Thesis:** Integrated development project/ Capstone project with two phases has to complete in the combine duration of two semester in 3rd year, 1st semester, phase-I (credit hour 1.00 and contact hour 2.00) and 3rd year, 2nd semester, phase-II (credit hour 1.00 and contact hour 2.00). The thesis/project will have to be undertaken in 4th year by students under separate supervisors in partial fulfillment of the requirement of his/her degree. Credits allotted to the thesis will be 6.00 and corresponding 12.00 contact hours where 6.00 contact hours in 4th year1st semester and another 6.00 contact hours in 4th year 2nd semester.

3.7 Course Registration

Any student who uses classroom, laboratory facilities or faculty-time is required to register formally. Upon admission to the BAUET, students are assigned to advisers. These advisers guide the students in choosing and registering courses.

3.7.1 Registration Procedure

At the commencement of each semester, each student has to register for courses in consultation with and under the guidance of his/her adviser. The date, time and venue of registration are announced in advance by the Registrar's Office. Counseling and advising are accomplished at this time. It is absolutely essential that all the students be present for registration at the specified time.

3.7.2 Preconditions for Registration

a. For first year students, department-wise enrollment/admission is mandatory prior to registration. At the beginning of the first semester, an orientation program will be conducted for them where they are handed over with the registration package on submission of the enrolment slip.
b. Any student, other than the new batch, with outstanding dues to the BAUET or a hall of residence is not permitted to register. Each student must clear their dues and obtain a clearance certificate, upon production of which, he/she will be given necessary Course Registration Forms to perform course registration.
c. A student is allowed to register in a particular course subject to the class capacity constraints and satisfaction of pre-requisite courses. However, even if a student fails in a pre-requisite course in any semester, the concerned department (BUGS) may allow him/her to register for a course which depends upon the pre-requisite course provided that his/her attendance and performance in the continuous assessment of the mentioned pre-requisite course is found to be satisfactory.

3.7.3 Registration Deadline

Each student must register for the courses to be taken before the commencement of each semester. Late registration is permitted only during the first week of classes. Late registration after this date will not be accepted unless the student submits a written application to the registrar through the concerned Head of the department explaining the reasons for delay. Acceptable reasons may be medical problems with supporting documents from the Medical Officer of BAUET or some other academic commitments that prohibit enrollment prior to the last date of registration.

3.7.4 Penalty for Late Registration

Students who fail to register during the designated dates for registration are charged a late registration fee of Tk. 400.00 (Four hundred only) per semester. Penalty for late registration will not be waived.

3.8 Course Appraisal and Lesson Plan

All faculty members must have to prepare their respective Course Appraisal and Lesson plan for the entire course before the semester begins. They are advised to leave a copy of the Course Appraisal set to the Head of the Department for review by the Course Committee.

3.9 Teacher-Student Interaction

3.9.1 Student Mentoring

Besides the respective faculty of each subject/program, every student wil have a designated mentor. Students will interact with his/her mentor to discuss the academic progress, difficulties and all other issues relating to their performances. There is definite guideline issued, which specifies the modalities and frequency of mentoring, advising and interactions.

3.9.2 Student Adviser

One adviser is normally appointed for a batch of students by the concerned department. The adviser advises each student about the courses to be taken in each semester by discussing the academic program of that particular semester with the student. However, it is also the student's responsibility to keep regular contact with his/her adviser who will review and eventually approve the student's specific plan of study and monitor subsequent progress of the student.

3.10 Attendance, Conduct and Discipline

BAUET has strict rules regarding the issues of attendance in class and discipline.

3.10.1 Attendance: Following guidelines are to be adjusted to:
a. All students are required to attend 80% of the classes for all courses.
b. In case of sickness 70% attendance may be considered by the VC with proper medical documents provided by the student.
c. Students failing to attend 80% classes are liable to pay a fine of Tk. 2000/- per course.
d. Students not eligible to sit for exam of a particular course due to poor attendance, their concerned course will be deleted form the Admit Card.
e. A student will not be entitled to Vice Chancellor or the Dean's list of the Semester, in case he/she has not attended 90% if the classes. S/he will also not be considered for any Scholarship/Waiver provide by the University.

The guidelines for attendance marks are as follows:

Category	Marks
For Theory Course	5
For Sessional Courses	10

The attendance marks distribution for the final assessment is as following:

Attendance (100)	Theory (05) Marks	Sessional (10) Marks
90% and above	05	As per earned percentage (%) of Attendance.
85% to 89%	4.5	
80% to 84%	04	
75% to 79%	3.9	
70% to 74%	03	
Below 70%	00	

3.10.2 Conduct and Discipline: During their stay in BAUET all students are required to abide by the existing rules, regulations and code of conduct. Students are strictly forbidden to form or be members of student organization or political party, club, society etc., other than those set up by BAUET authority in order to enhance student's physical, intellectual, moral and ethical development. Zero tolerance will be shown in regards of sexual abuse and harassment in any forms and drug abuse and addiction in the campus.

3.11 The Grading System

The total performance of a student in a given course is based on a scheme of continuous assessment, for theory courses this continuous assessment is made through a set of quizzes, class tests, class evaluation, class observation, assignment and a semester final examination. The assessments for sessional courses are made by evaluating performance of the student at work during the class, viva-voce during laboratory hours and quizzes. Besides that, at the end there will be a final lab test. Each course has a certain number of credits, which describes its corresponding weightages. A student's performance is measured by the number of credits completed satisfactorily and by the weighted average of the grade points earned. A minimum grade point average (GPA) is essential for satisfactory progress. A minimum number of earned credits also have to be acquired in order to qualify for the degree. Letter grades and corresponding grade points will be given as follows

Numerical Score	Letter Grade		Grade points
80% and above	A+	A (Plus)	4.00
75% to below 80%	A	A (Regular)	3.75
70% to below 75%	A-	A (Minus)	3.50
65% to below 70%	B+	B (Plus)	3.25
60% to below 65%	B	B (Regular)	3.00
55% to below 60%	B-	B (Minus)	2.75
50% to below 55%	C+	C (Plus)	2.50
45% to below 50%	C	C (Regular)	2.25
40% to below 45%	D	D (Pass)	2.00
below 40%	F	Fail	0.00
Incomplete	I	-	-
Withdrawal	W	-	-
Projects/Thesis Continuation	X	-	-

*Subject in which the student gets F grade shall not be regarded as earned credit hours for the calculation of Grade Point Average (GPA).

3.11.1 Distribution of Marks

Theory: Thirty percent (30%) marks of theoretical course shall be allotted for continuous assessment, i.e., quizzes, class tests, home assignments, class evaluation and class participation and 70% shall be allotted to the Semester Final Examination.

The semester final examination is conducted centrally by the university. Distribution of marks for a given course if as follows.

Category	Marks
Class participation/Observation/Performance	5%
Homework/Assignment/Quizzes	5%
Class tests	20%
Final Examination (Maximum 3 Hours)	70%
Total	**100**

Sessional: Sessional courses are designed and conducted by the concerned departments. Examination on sessional/practical subjects will be conducted by the respective department before the commencement of semester final examination. The date of practical examination will be fixed by the respective department. Students will be evaluated in the sessional courses on the basis of the followings (all or as decided by the Examination Sub-Committee):

Lab/ Project-Based Sessional:

Distribution of marks	
Categories	**Marks**
Lab Test/ Project	30%
Written Test/ Quiz	20%
Viva-voce	10%
Attendance	10%
Data Sheet/ Home Assignment/ Report	10%
Class Performance/ Continuous Evaluation	20%
Total	**100%**

Programming Based Sessional:

Distribution of marks	
Category	**Marks**
Online Test – 1	25%
Online Test – 2	25%
Viva voce	10%
Attendance	10%
Continuous Evaluation	10%
Class Performance	20%
Total	**100**%

Sessional Course in English:

Distribution of marks	
Categories	**Marks**
Class Performance	5%
Class Observation	5%
Written Assignment	15%
Oral Performance	25%
Listening Skill	10%
Group Presentation	30%
Viva Voce	10%
Total	**100%**

3.11.2 Calculation of GPA

Grade Point Average (GPA) is the weighted average of the grade points obtained of all the courses passed/completed by a student. For example, if a student passes/completes *n* courses in a semester having credits of C_1, C_2, … , C_n and his grade points in these courses are G_1, G_2, … , G_n respectively then

$$GPA = \frac{\sum_{i=1}^{n} C_i \times G_i}{\sum_{i=1}^{n} C_i}$$

The Cumulative Grade Point Average (CGPA) is the weighted average of the GPA obtained in all the Semesters passed/completed by a student. For example, if a student passes/ completes n Semesters having total credits of TC_1, TC_2, … , TC_n and his GPA in these Semesters are GPA_1, GPA_2, GPA_n respectively then

$$CGPA = \frac{\sum_{i=1}^{n} TC_i \times GPA_i}{\sum_{i=1}^{n} TC_i}$$

Numerical Example
Suppose a student has completed eight courses in a semester and obtained the following grades:

Course	Credits, C_i	Grade	Grade Point, G_i	$C_i \times G_i$
EEE 1101	3.00	A+	4.00	12.00
EEE 1102	1.50	A-	3.50	5.25
PHY 1111	4.00	A+	4.00	16.00
PHY 1112	1.50	A+	4.00	6.00
MATH 1111	3.00	B	3.00	9.00
CHEM 1111	3.00	A	3.75	11.25
CHEM 1112	1.00	A	3.75	3.75
HUM 1121	2.00	B-	2.75	5.50
Total	19.00			68.75

GPA = 68.75/19.00= 3.62

Suppose a student has completed four Semesters and obtained the following GPA:

Level	Semester	Credit Earned, TC_i	GPA Earned, GPA_i	$GPA_i \times TC_i$
1	1	21.00	3.73	78.330
1	2	20.50	3.93	80.565
2	1	19.75	3.96	78.210
2	2	20.25	4.00	81.000
Total		**81.50**		**318.105**

CGPA = 318.105/81.50 = 3.90

3.12 Promotion to the Next Semester

[As per BAUET Exam policy]

3.13 Minimum Earned Credit and CGPA Required for Obtaining a Degree

[As per BAUET Exam policy]

3.14 Consequences of Poor Performance (Referred/Improvement/Backlog/Semester Repetition)

[As per BAUET Exam policy]

3.15 Withdrawal Policy

[As per BAUET Exam policy]

3.16 Time Limits for Completion of Bachelor's Degree

A student must complete his/her studies within a maximum period of six academic years for completion of B.Sc. Engineering degree.

3.17 Class Tests

The number for class test of a course shall be at least n+1 where n is the number of credits of the course. Class test will be conducted by the subject teacher. Course teacher must announce results within 10 days of holding the examination. Checked scripts will be shown to the students. If a student misses the class test for acceptable reason, the course teacher may make arrangements to take the test of the students.

3.18 Earned Credits

The courses in which a student has obtained 'D' or a higher grade will be counted as credits earned by her/him. Any course in which a student has obtained 'F' grade will not be counted as credits earned by her/him.

3.19 Rounding off the Decimal Marks

If there is any decimal marks in any of the examinations like class test, tutorial, semester paper, viva voce, course final examination, instead of rounding off the decimal figure in the result of every subject/sessional, it is to be rounded off only once during tabulation while converting the total marks to summation of all the subject/sessional marks. To round off, 0.5 and above is to be

converted to next higher whole number(Integer) and less than 0.5 is to be converted to previous whole number (For example 58.5% would be 59% and 58.49% would 58%).

3.20 Rounding off the GPA/CGPA

The GPA/CGPA is not to be rounded off like the total marks of each subject sessional, but it is to be rounded off after two figures of decimal. To round of 3.555 and above after two figure of decimal, it is to be rounded off as 3.56 and 3.554 and below after two figure of decimal, it is to be rounded off as 3.55.

3.21 Number of Grade Sheets

The number of Grade sheets to be issued is 08 (eight) for a regular student. Backlog, re-registered courses, sessional courses result will be included in that particular semester result in which the student appeared.

3.22 Transcript

Transcripts will be given after approval of the authority of BAUET, academic council and syndicate. Partial transcripts may be given to students with the assigned payment and verification fixed by the authority.

3.23 Certificate

A copy of provisional before original certificate may be given after approval of the authority of BAUET, academic council and syndicate. Provisional certificates, however, should be surrendered during receiving the original certificate.

3.24 Recognition of Performance

a. **Degree with Honors:** Candidates for Bachelor's Degree will be awarded the degree with honors if their overall CGPA is 3.75 and above.
b. **Gold Medal:** Gold medal will be awarded to all students earning CGPA 4 at the end of the entire program.
c. **VC's List:** VC's list will be awarded to all students earning 3.90 and above at the end of each academic level, and all graduating students earning 3.90 and above considering results of entire program.
d. **Dean's List:** Dean's list will be awarded to all students earning CGPA 3.75 - 3.90 at the end of each academic year for 1, 2, 3 and all graduating students earning CGPA 3.75 - 3.90 considering results of entire program.
e. **Other Scholarships and Stipends:** This will be considered by the university authority.

**Students must have above 90% attendance to be considered in the Dean's list and VC's list of recognition.

[N.B. Contradiction among the existing Examination Policy, Syllabus and Standing Instruction (SI) will be solved by a team headed by the honorable VC]

Chapter 4

Course Curriculum for Bachelor Degree in EEE

The list of course offered to the students of Electrical and Electronic Engineering (EEE) are categorized into Core courses and Elective courses. Some of the core courses are offered by the Department of EEE and some by other departments. Elective courses are grouped into Power, Electronics, Communication, Signal Processing and Interdisciplinary groups. Students have the flexibility to choose from amongst the Elective courses.

4.1 Distribution of Courses

Sl. No.	Department		Course Type-Credit Hour			Contact hours	Credit hours
			Theory	Sessional	Project/Thesis and others		
1	EEE	Core Courses	63.00	22.00	6.00+2.00+1.00	125	94.00
		Elective Courses	15.00	1.50	-	18.00	16.50
2	CSE		3.00	1.50	-	6.00	4.50
3	CE		-	1.50	-	3.00	1.50
4	ME		6.00	1.00	-	8.00	7.00
5	Physics		4.00	1.50	-	7.00	5.50
6	Chemistry		3.00	1.00	-	5.00	4.00
7	Mathematics		12.00	-	-	12.00	12.00
8	Humanities		14.00	1.00	-	16.00	15.00
Total						**200**	**160.00**

4.2 Core Courses for EEE Undergraduate Program

List of Core Courses-EEE

Sl. No	Corse Code	Course Title	Credit hours
1.	EEE 1101	Electrical Circuits I	3.00
2.	EEE 1102	Electrical Circuits I Sessional	1.50
3.	EEE 1205	Electrical Circuits II	3.00
4.	EEE 1206	Electrical Circuits II Sessional	1.50
5.	EEE 2101	Electronic Circuits I	3.00
6.	EEE 2102	Electronics Circuits-I Sessional	1.50
7.	EEE 2103	Electrical Machines I	3.00
8.	EEE 2201	Signals and Linear Systems	3.00
9.	EEE 2205	Electrical Machines II	3.00
10.	EEE 2206	Electrical Machines Sessional	1.50
11.	EEE 2207	Electronic Circuits II	3.00
12.	EEE 2208	Electronics Circuits II Sessional	1.50
13.	EEE 2211	Numerical Methods	3.00
14.	EEE 2212	Numerical Methods Sessional	1.50

15.	EEE 3103	Digital Electronics	3.00
16.	EEE 3104	Digital Electronics Sessional	1.50
17.	EEE 3105	Power System I	3.00
18.	EEE 3106	Power System I Sessional	1.50
19.	EEE 3109	Communication System I	3.00
20.	EEE 3110	Communication System I Sessional	0.75
21.	EEE 3113	Electrical Measurement, Instrumentation and Sensors	3.00
22.	EEE 3114	Electrical Measurement, Instrumentation and Sensors Sessional	1.50
23.	EEE 3117	Engineering Electromagnetic	3.00
24.	EEE 3100	Integrated Design Project I	1.00
25.	EEE 3201	Control System I	3.00
26.	EEE 3202	Control System I Sessional	1.00
27.	EEE 3209	Communication system II	3.00
28.	EEE 3210	Communication System II Sessional	0.75
29.	EEE 3211	Digital Signal Processing I	3.00
30.	EEE 3212	Digital Signal Processing I Sessional	1.50
31.	EEE 3217	VLSI I	3.00
32.	EEE 3218	VLSI I Sessional	0.75
33.	EEE 3230	Industrial Training	1.00
34.	EEE 3200	Integrated Design Project II	1.00
35.	EEE 4000	Project/Thesis	6.00
36.	EEE 4107	Microprocessors and Embedded System	3.00
37.	EEE 4108	Microprocessors and Embedded System Sessional	0.75
38.	EEE 4122	Electrical Service Design & CAD Sessional	0.75
39.	EEE 4101	Biomedical Signals and Systems	3.00
40.	EEE 4102	Biomedical Signals and Systems Sessional	0.75
41.	EEE 4201	Solid State Devices	3.00
42.	EEE 4273	Power Electronics	3.00
43.	EEE 4274	Power Electronics Sessional	1.50
		Total	**97.00**

List of Core Courses-CSE

Sl. No	Corse Code	Course Title	Credit hours
1	CSE 1209	Computer Programming	3.00
2	CSE 1210	Computer Programming Sessional	1.50
		Sub Total	**4.50**

List of Core Courses-CE

Sl. No	Corse Code	Course Title	Credit hours
1	CE 1252	Engineering Drawing	1.50
		Sub Total	**1.50**

List of Core Courses-ME

Sl. No	Corse Code	Course Title	Credit hours
1	ME 2163	Fundamentals of Mechanical Engineering	3.00
2	ME 2164	Fundamentals of Mechanical Engineering Sessional	1.00
3	ME 4193	Industrial Management	3.00
		Sub Total	**7.00**

List of Core Courses-Physics

Sl. No	Corse Code	Course Title	Credit hours
1	PHY 1111	Physics	4.00
2	PHY 1112	Physics Sessional	1.50
		Sub Total	**5.50**

List of Core Courses-Chemistry

Sl. No	Corse Code	Course Title	Credit hours
1	CHEM 1211	Chemistry	3.00
2	CHEM 1212	Chemistry Sessional	1.00
		Sub Total	**4.00**

List of Core Courses-Mathematics

Sl. No	Corse Code	Course Title	Credit hours
1	MATH 1111	Engineering Mathematics-I	3.00
2	MATH 1215	Engineering Mathematics-II	3.00
3	MATH 2111	Engineering Mathematics-III	3.00
4	MATH 2213	Engineering Mathematics-IV	3.00
		Sub Total	**12.00**

List of Core Courses-Humanities

Sl. No	Corse Code	Course Title	Credit hours
1	HUM 1153	Bengali Language and Literature	2.00
2	HUM 1171	Technical English	2.00
3	HUM 1172	Technical English Sessional	1.00
4	HUM 1255	Bangladesh Studies (History of Independence)	2.00
5	HUM 2127	Financial and Managerial Accounting	3.00
6	HUM 2177	Fundamentals of Economics	2.00
7	HUM 3257	Society, Environment and Ethics	3.00
		Sub Total	**15.00**

Final Year Thesis and Integrated Design Project

Thesis and Capstone project will have to be undertaken by students under separate supervisors in partial fulfillment of the requirement of his/her degree. Credits allotted to the thesis will be 6.00 and to the Integrated Design Project will be 2.00 corresponding to 12 Contact hours and 04 Contact hours respectively. Topic and advisor selection of capstone project must be finalized within 3rd Year, 1st Semester.

4.3 Elective Courses

From 4th year, 1st Semester, EEE Department starts offering elective courses under 3 groups viz. Power, Communication and Signal Processing and Electronics. There are total five elective courses. Out of which students will have to take at least three courses from individual group. The last two courses may be taken from individual group or other groups or Interdisciplinary group or combination of these groups.

Rules for distributing major and minor groups and elective courses are as follows:

1. Students will be assigned one of the three groups as major and another as minor by taking written options from the students. For regular students, this will be done in 3rd year, 2nd semester.
2. Maximum number of students in any group as will be N/3± 0.15N, where N is the number of students in a batch. However, this number may be changed because of service requirement for distributing groups among military students.
3. Major and minor group assignment will be based on options and CGPA of first five semesters from 1st year, 1st semester to 3rd year, 1st semester. For military students, service requirement may be given priority.
4. A student will have to take at least three elective theory courses from the respective group and remaining 2 elective theory courses may be selected from the respective group or other groups or interdisciplinary group or combination of these groups.
5. Students will be assigned their 4th year theses/projects from the area of the respective group.
6. For selection of elective theory courses, preference will be given to the courses with higher number of choice from students and availability of teachers.
7. A student can take extra elective courses from any group in addition of minimum credit hours' requirement to obtain bachelor's degree.
8. In case of any unforeseen situation or ambiguity, the Departmental BUGS will take an appropriate decision

List of Elective Courses-Power

Sl. No.	Course Code	Course Title	Year	Credit hours
1	EEE 4*71	Power System II	4-I/ 4-II	3.00
2	EEE 4*73	Renewable Energy	4-I/ 4-II	3.00
3	EEE 4*75	Power Plant Engineering	4-I/ 4-II	3.00
4	EEE 4*77	Power System Protection	4-I/ 4-II	3.00
5	EEE 4*78	Power System Protection Sessional	4-I/ 4-II	1.50
6	EEE 4*79	Power System Reliability	4-I/ 4-II	3.00
7	EEE 4*81	Power System Operation and Control	4-I/ 4-II	3.00
8	EEE 4*83	High Voltage Engineering	4-I/ 4-II	3.00
9	EEE 4*84	High Voltage Engineering Sessional	4-I/ 4-II	1.50

10	EEE 4*85	Electrical Machines III	4-I/ 4-II	3.00

List of Elective Courses-Electronics

Sl. No.	Course Code	Course Title	Year	Credit hours
1	EEE 4*51	Processing and Fabrication Technology	4-I/ 4-II	3.00
2	EEE 4*53	Analog Integrated Circuits	4-I/ 4-II	3.00
3	EEE 4*55	Compound Semiconductor and Hetero-junction Devices	4-I/ 4-II	3.00
4	EEE 4*57	VLSI II	4-I/ 4-II	3.00
5	EEE 4*58	VLSI II Sessional	4-I/ 4-II	1.50
6	EEE 4*59	Optoelectronics	4-I/ 4-II	3.00
7	EEE 4*61	Semiconductor Device Theory	4-I/ 4-II	3.00

List of Elective Courses-Communication and Signal processing

Sl. No.	Course Code	Course Title	Year	Credit hours
1	EEE 4*03	Telecommunication Engineering	4-I/ 4-II	3.00
2	EEE 4*31	Digital Signal Processing II	4-I/ 4-II	3.00
3	EEE 4*33	Microwave Engineering	4-I/ 4-II	3.00
4	EEE 4*34	Microwave Engineering Sessional	4-I/ 4-II	1.50
5	EEE 4*35	Optical Fiber Communication	4-I/ 4-II	3.00
6	EEE 4*37	Digital Communication	4-I/ 4-II	3.00
7	EEE 4*38	Digital Communication Sessional	4-I/ 4-II	1.50
8	EEE 4*39	Mobile Cellular Communication	4-I/ 4-II	3.00
9	EEE 4*41	Random Signals and Processes	4-I/ 4-II	3.00
10	EEE 4*43	Radar and Satellite Communication	4-I/ 4-II	3.00
11	EEE 4*44	Radar and Satellite Communication Sessional	4-I/ 4-II	1.50
12	EEE 4*45	Communication Networks	4-I/ 4-II	3.00
13	EEE 4*46	Communication Networks Sessional	4-I/ 4-II	1.50

List of Elective Courses-Interdisciplinary

Sl. No.	Course Code	Course Title	Year	Credit hours
1	EEE 4*21	Control System II	4-I/ 4-II	3.00
2	EEE 4*22	Control System II Sessional	4-I/ 4-II	1.50
3	EEE 4*99	Antenna Array Signal Processing	4-I/ 4-II	3.00
4	CSE 4*91	Microprocessor System Design	4-I/ 4-II	3.00
5	CSE 4*92	Microprocessor System Design Sessional	4-I/ 4-II	1.50

4.4 Contact hours and Credit Hours Distribution in Eight Semesters

Year/Semester.	Theory		Sessional		Total Contact hours / week	Total Credit hours
	Contact hours / week	**Credit hours**	**Contact hours / week**	**Credit hours**		
1st Year 1st Semester	14.00	14.00	8.00	4.00	22.00	18.00
1st Year 2nd Semester	14.00	14.00	11.00	5.50	25.00	19.50
2nd Year 1st Semester	17.00	17.00	5.00	2.50	22.00	19.50
2nd Year 2nd Semester	15.00	15.00	9.00	4.50	24.00	19.50
3rd Year 1st Semester	15.00	15.00	12.50	6.25	27.50	21.25
3rd Year 2nd Semester	15.00	15.00	12.00	6.00	27.00	21.00
4th Year 1st Semester	15.00	15.00	10.50	5.25	25.50	20.25
4th Year 2nd Semester	15.00	15.00	12.00	6.00	27.00	21.00
Total	**120.00**	**120.00**	**80**	**40**	**200**	**160**

4.4 Sequence of Offered Courses in Eight Semesters

1st Year 1st Semester					
Sl. No	**Course Code**	**Course Title**	**Type of Course**	**Contact hours / week**	**Credit hours**
1	EEE 1101	Electrical Circuits I	Theory	3.00	3.00
2	EEE 1102	Electrical Circuits I Sessional	Sessional	3.00	1.50
3	PHY 1111	Physics	Theory	4.00	4.00
4	PHY 1112	Physics Sessional	Sessional	3.00	1.50
5	MATH 1111	Engineering Mathematics I	Theory	3.00	3.00
6	HUM 1171	Technical English	Theory	2.00	2.00
7	HUM 1172	Technical English Sessional	Sessional	2.00	1.00
8	HUM 1153	Bengali Language and Literature	Theory	2.00	2.00
Total				**22.00**	**18.00**

1st Year 2nd Semester					
Sl. No	**Course Code**	**Course Title**	**Type of Course**	**Contact hours / week**	**Credit hours**
1	EEE 1205	Electrical Circuits II	Theory	3.00	3.00
2	EEE 1206	Electrical Circuit II Sessional	Sessional	3.00	1.50
3	CSE 1209	Computer Programming	Theory	3.00	3.00
4	CSE 1210	Computer Programming Sessional	Sessional	3.00	1.50
5	CE 1252	Engineering Drawing	Sessional	3.00	1.50
6	MATH 1215	Engineering Mathematics II	Theory	3.00	3.00
7	CHEM 1211	Chemistry	Theory	3.00	3.00
8	CHEM 1212	Chemistry Sessional	Sessional	2.00	1.00
9	HUM 1255	Bangladesh Studies (History of Independence)	Theory	2.00	2.00
Total				**25.00**	**19.50**

2nd Year 1st Semester					
Sl. No	**Course Code**	**Course Title**	**Type of Course**	**Contact hours / week**	**Credit hours**
1	EEE 2101	Electronic Circuits I	Theory	3.00	3.00
2	EEE 2102	Electronic Circuits I Sessional	Sessional	3.00	1.50
3	EEE 2103	Electrical Machines I	Theory	3.00	3.00
4	ME 2163	Fundamentals of Mechanical Engineering	Theory	3.00	3.00
5	ME 2164	Fundamentals of Mechanical Engineering Sessional	Sessional	2.00	1.00
6	MATH 2111	Engineering mathematics III	Theory	3.00	3.00
7	HUM 2127	Financial and Managerial Accounting	Theory	3.00	3.00
8	HUM 2177	Fundamentals of Economics	Theory	2.00	2.00
Total				**22.00**	**19.50**

2nd Year 2nd Semester					
Sl. No	**Course Code**	**Course Title**	**Type of course**	**Contact hours / week**	**Credit hours**
1	EEE 2201	Signals and Linear Systems	Theory	3.00	3.00
2	EEE 2205	Electrical Machines II	Theory	3.00	3.00
3	EEE 2206	Electrical Machines Sessional	Sessional	3.00	1.50
4	EEE 2207	Electronic Circuits II	Theory	3.00	3.00
5	EEE 2208	Electronics Circuit II Sessional	Sessional	3.00	1.50
6	EEE 2211	Numerical Methods	Theory	3.00	3.00
7	EEE 2212	Numerical Methods Sessional	Sessional	3.00	1.50
8	MATH 2213	Engineering Mathematics IV	Theory	3.00	3.00
Total				**24.00**	**19.50**

3rd Year 1st Semester					
Sl. No	**Course Code**	**Course Title**	**Type of course**	**Contact hours / week**	**Credit hours**
1	EEE 3100	Integrated Design Project I	-	2.00	1.00
2	EEE 3103	Digital Electronics	Theory	3.00	3.00
3	EEE 3104	Digital Electronics Sessional	Sessional	3.00	1.50
4	EEE 3105	Power System I	Theory	3.00	3.00
5	EEE 3106	Power System I Sessional	Sessional	3.00	1.50
6	EEE 3109	Communication system I	Theory	3.00	3.00
7	EEE 3110	Communication System-I Sessional	Sessional	1.50	0.75
8	EEE 3113	Electrical Measurement, Instrumentation and Sensors	Theory	3.00	3.00
9	EEE 3114	Electrical Measurement Instrumentation and Sensors Sessional	Sessional	3.00	1.50
10	EEE 3117	Engineering Electromagnetic	Theory	3.00	3.00
Total				**27.50**	**21.25**

3rd Year 2nd Semester					
Sl. No	**Course Code**	**Course Title**	**Type of course**	**Contact hours / week**	**Credit hours**
1	EEE 3200	Integrated Design Project II	-	2.00	1.00
2	EEE 3201	Control System I	Theory	3.00	3.00
3	EEE 3202	Control System-I Sessional	Sessional	2.00	1.00
4	EEE 3209	Communication System II	Theory	3.00	3.00
5	EEE 3210	Communication System II Sessional	Sessional	1.50	0.75
6	EEE 3211	Digital signal Processing-I	Theory	3.00	3.00
7	EEE 3212	Digital signal Processing I Sessional	Sessional	3.00	1.50
8	EEE 3217	VLSI I	Theory	3.00	3.00
9	EEE 3218	VLSI I Sessional	Sessional	1.50	0.75
10	EEE 3230*	Industrial Training	-	2.00* (6 Weeks)	1.00
11	HUM 3257	Society, Environment and Ethics	Theory	3.00	3.00
Total				**27.00**	**21.00**

*EEE 3230 (Industrial Training/attachment) will be conducted at any convenient time after the year end exam of sem-2 for a duration of 06 weeks as applicable or decided by the department.

4th Year 1st Semester					
Sl. No	**Course Code**	**Course Title**	**Type of Course**	**Contact hours / week**	**Credit hours**
1	EEE 4000	Project and Thesis	-	6.00	3.00
2	EEE 4101	Biomedical Signals and Systems	Theory	3.00	3.00
3	EEE 4102	Biomedical Signals and Systems Sessional	Sessional	1.50	0.75
4	EEE 4107	Microprocessors and Embedded System	Theory	3.00	3.00
5	EEE 4108	Microprocessors and Embedded System Sessional	Sessional	1.50	0.75
6	EEE 41**	Elective I	Theory	3.00	3.00
7	EEE 41 **	Elective II	Theory	3.00	3.00
8	EEE 4122	Electrical Service Design & CAD Sessional	Sessional	1.50	0.75
9	ME 4193	Industrial Management	Theory	3.00	3.00
Total				**25.50**	**20.25**

4th Year 2nd Semester					
Sl. No	**Course Code**	**Course Title**	**Type of Course**	**Contact hours / week**	**Credit hours**
1	EEE 4000	Project and Thesis	-	6.00	3.00
2	EEE 4201	Solid State Devices	Theory	3.00	3.00
3	EEE 4273	Power Electronics	Theory	3.00	3.00
4	EEE 4274	Power Electronics Sessional	Sessional	3.00	1.50
5	EEE 42**	Elective III	Theory	3.00	3.00
6	EEE 42 **	Elective IV	Theory	3.00	3.00
7	EEE 42**	Elective IV Sessional	Sessional	3.00	1.50
8	EEE 42**	Elective V	Theory	3.00	3.00
Total				**27.00**	**21.00**

Chapter 5

Details of Core Courses Offered by the Department of EEE

EEE 1101: Electrical Circuit I **Credit Hour: 3.00**

Course Content

Circuit Variables and Elements: Voltage, current, power, energy, independent and dependent sources, resistance, inductance and capacitance. Introduction to non-sinusoidal waveforms, calculation of RMS and average value for non-sinusoidal waveforms.

Basic Laws: Ohm's law, Kirchhoff's current and voltage laws. Voltage divider and current divider rules, Delta-Wye equivalent circuits. Series, parallel and series-parallel circuits and their equivalents.

Techniques for Circuit Analysis: Nodal and mesh analysis including supernode and supermesh. Techniques of General DC/AC Circuit Analysis (containing both independent and dependent sources): Node-voltage method, Mesh-current method, Source transformations.

Network Theorem: Thevenin's theorem, Norton's theorem and superposition theorem with applications in circuits having independent and dependent sources, Millman's theorem, Compensation theorem, Maximum power transfer theorem and Reciprocity theorem.

Energy Storage Elements: Properties of Inductances and capacitances, Series-parallel combinations of inductances and capacitances, Responses of RL and RC circuits: Natural and step responses.

Sinusoidal Functions: Instantaneous current, voltage, power, effective current and voltage, average power, phasor and complex quantities. Impedance, admittance, reactance, susceptance of RL, RC and RLC branches.

Analysis of Single Phase AC Circuits: Vector diagram representation of AC circuits, Series and parallel RL, RC and RLC circuits, Techniques of general ac circuit analysis (containing both independent and dependent sources), nodal and mesh analysis for AC circuits, application of network theorems in AC circuit analysis.

Resonance in AC Circuits: Series resonance, Parallel Resonance, Q value and Bandwidth.

Magnetic Circuits: Quantities and Variables for Magnetic circuits, B-H Curve, reluctance, and magnetic field strength. Ohm's law and Ampere's circuital law for Magnetic Circuits. Analysis of series, parallel and series-parallel magnetic circuits. Comparison between electrical and magnetic quantities, Hysteresis and hysteresis loss. Magnetic materials.

Recommended Books

1	Fundamentals of Electric Circuits	:	Charles K. Alexander and Mathew N. O. Sadiku
2	Introductory Circuit Analysis	:	Robert L. Boylestad
3	Alternating-current Circuits	:	G. F. Corcoran and R. M. Kerchner

EEE 1102: Electrical Circuits I Sessional **Credit Hour: 1.50**

Course Content

In this course students will get a hands on experience about electrical circuits. They will observe the uses of electrical circuits practically. They will also simulate and analyze different electrical circuits and find out different values of elements inside the circuits using PSpice**.**

Recommended Books

1	Introductory Circuit Analysis	:	R.L Boylestad; Prentice Hall of India Private Ltd.
2	Introductory Circuits for Electrical & Computer Engineering	:	James. W. Nilson; Prentice Hall of India Private Ltd.

EEE 1205: Electrical Circuits II **Credit Hours: 3.00**

Course Content

AC Power Concepts: Classification of AC power circuits with non-sinusoidal excitations, power and power factor calculation of ac circuits with multiple sources of different frequencies, power factor improvement of AC system.

Transient Analysis of Linear Circuits: Transient response of RL, RC and RLC circuits with sinusoidal and step excitation.

Magnetically Coupled Circuits: Mutual Inductance, Energy in a Coupled Circuit, Linear Transformers, Ideal Transformers, Ideal Auto transformers.

Analysis of Balanced Three Phase Circuits: Balanced Three-Phase Voltages, Balanced Wye-Wye Connection, Balanced Wye-Delta Connection, Balanced Delta-Delta Connection, Balanced Delta-Wye Connection, Power in a Balanced System.

Analysis of Unbalanced Three Phase Circuits: Combination of Wye and Delta connection for unbalanced system, the wye-wye system with neutral connection, methods of checking voltage phase sequence, three phase power measurement, power factor in unbalanced three phase systems.

Two-port analysis: Impedance parameters, Voltage gains, Current gains, Cascaded systems, admittance parameters, Hybrid parameters.

Passive Filter Networks: Properties of symmetrical networks, Characteristic impedance and attenuation, ladder network, Filter fundamentals, different types of filters, propagation coefficient and time delay in filter sections, practical composite filters, Constant-K filter, design considerations.

Recommended Books

1	Fundamental of Electric Circuits	:	Charles K. Alexander, Matthew N. O Sadiku.
2	Introductory Circuit Analysis	:	R.L Boylestad; Prentice Hall of India Private Ltd.
3	Introductory Circuits for Electrical & Computer Engineering	:	James. W. Nilson; Prentice Hall of India Private Ltd.

EEE 1206: Electrical Circuits II Sessional **Credit Hours: 1.50**

Course Content

Students will perform experiments to verify practically the theories and concepts learned in EEE 1205. They will also do simulation laboratory based on EEE 1205 theory courses. Students will

verify the theories and concepts learned in EEE 1205 using simulation software like Pspice and MATLAB. Students will also perform specific design of AC circuits theoretically and by simulation.

Recommended Books

1	Introductory Circuit Analysis	:	R.L Boylestad; Prentice Hall of India Private Ltd.
2	Fundamental of Electric Circuits	:	Charles K. Alexander, Matthew N. O Sadiku.
3	Introductory Circuits for Electrical & Computer Engineering	:	James. W. Nilson; Prentice Hall of India Private Ltd.

EEE 2101:Electronic Circuits I **Credit Hours: 3.00**

Course Content

P-N junction as a circuit element: Intrinsic and extrinsic semiconductors, operational principle of p-n junction diode, contact potential, current-voltage characteristics of a diode, simplified DC and AC diode models, dynamic resistance and capacitance.

Diode circuits: Half wave and full wave rectifiers, rectifiers with filter capacitor, characteristics of a zener diode, zener shunt regulator, clipping and clamping circuits.

Bipolar Junction Transistor (BJT) as a circuit element: BJT current components, BJT characteristics and regions of operation, BJT as an amplifier, biasing the BJT for discrete circuits, small signal equivalent circuit models, BJT as a switch. Single stage mid-band frequency.

BJT amplifier circuits: Voltage and current gain, input and output impedance of a common base, common emitter and common collector amplifier circuits.

Field Effect Transistor (FET): Structure and physical operation of FET, JFET, transfer characteristics and pinch-off voltage. Differential and multistage amplifiers: Description of differential amplifiers, small-signal operation, differential and common mode gains, RC coupled mid-band frequency amplifier.

Metal Oxide Semiconductor Field Effect Transistor (MOSFET): Structure and physical operation of depletion and enhancement MOSFET, threshold voltage, Body effect, current-voltage characteristics of an enhancement MOSFET, biasing discrete and integrated MOS amplifier circuits, single-stage MOS amplifiers, MOSFET as a switch, CMOS inverter.

Recommended Books

1	Electronic Device and Circuit Theory	:	Robert L. Boylestad
2	Microelectronic circuit	:	Sedra Smith
3	Electronic Devices Circuits	:	Millman and Halkias

EEE 2102:Electronic Circuits I Sessional **Credit Hours: 1.50**

Course Content

In this course students will perform experiments to verify practically the theories and concepts learned in EEE 2101. They will also perform simulation based on the theory course using simulation software like Pspice, MATLAB etc.

Recommended Book

1	Spices for Circuits and Electronic Using Pspice	:	MD. H. Rashid; Prentice Hall of India

EEE 2103:Electrical Machines I **Credit Hours: 3.00**

Course Content

Energy Conversion: Review of law of energy conversions, electro-mechanical energy conversions.

DC generator: Construction, winding, types of losses, no-load voltage characteristics, build-up of a self-excited shunt generator, critical field resistance, load-voltage characteristic, effect of speed on no-load and load characteristics, voltage regulation, armature reaction and commutation.

DC motor: Torque, counter EMF, rotational speed, torque-speed characteristics, starting and speed control, regulation, braking.

Transformer: Principle, construction of ideal transformer, practical transformer, transformation ratio, no-load and load vector diagrams; actual transformer's equivalent circuit, regulation, short circuit and open circuit tests, parallel operation of transformers, auto transformer, instrument transformers, 3- phase transformers, different connection and their applications.

Recommended Books

1 Electrical Machinery Fundamentals : Stephen J Chapman
3 Electric Machinery and Transformers : Irving L. Kosow

EEE 2201:Signals and Linear Systems **Credit Hours: 3.00**

Course Content

Classification of signals and systems: Signals classification, basic operation on signals, elementary signals, representation of signals using impulse function, systems classification.

Properties of Linear Time Invariant (LTI) systems: Linearity, causality, time invariance, memory, stability.

Time domain analysis of LTI systems: Differential equations - system representation, order of the system, solution techniques, zero state and zero input response, system properties, impulse response - convolution integral, determination of system properties, state variable - basic concept, state equation and time domain solution.

Frequency domain analysis of LTI systems: Fourier series- properties, harmonic representation, system response, frequency response of LTI systems, Fourier transformation-properties, system transfer function, system response and distortion-less systems.

Applications of time and frequency domain analyses: Amplitude modulation and demodulation, time-division and frequency-division multiplexing.

Laplace transformation: Properties, inverse transform, solution of system equations, system transfer function, system stability and frequency response and application. Solution of analog electrical and mechanical systems.

Recommended Books

1 Analysis of Linear Systems : D K Cheng
2 Signals and Systems : Simon Haykin and B V Veen
3 Fundamentals of Electronic Circuits : Charles k. Alexander and Matthew N.O. Sadiku

EEE 2205:Electrical Machines II **Credit Hours: 3.00**

Course Content

Synchronous Generator: Principle excitation systems, construction, EMF equation, equivalent circuit, vector diagrams at different loads, factors affecting voltage regulation, synchronous impedance, synchronous impedance method of predicting voltage regulation and its limitations.
Parallel operation: Necessary conditions, synchronizing, circulating current and vector diagram, effect of change in excitation, mechanical input upon synchronizing.
Synchronous motor: Operation, effect of loading under different excitation condition, effect of changing excitation, V-curves and starting, hunting, application.
Three phase induction motor: Rotating magnetic field, equivalent circuit, vector diagram, torque-speed characteristics, effect of changing rotor resistance on torque-speed curves, motor torque and developed rotor power, no-load test, blocked rotor test, equivalent circuit starting and braking and speed control.
Single phase induction motor: Split phase motors, squirrel cage induction motors and other AC motors: Basic principles, types of operation, equivalent circuit, starting and torque speed characteristics, special types of motors.

Recommended Books

1	Electrical Machinery Fundamentals	:	Stephen J Chapman
2	Electric Machinery and Transformers	:	Irving L Kosow
3	A Textbook of Electrical Technology	:	B.L Theraja

EEE 2206:Electrical Machine Sessional **Credit Hours: 1.50**

Course Content

In this course students will get hands on experience about different DC and AC electrical machines. They will observe the characteristics of electrical machines practically. They will also learn to analyze different electrical machines for evaluating their operations, performances and uses. After all, students will perform experiments to verify practically the theories and concepts learned in EEE 2205.

Recommended Books

1	Electrical Machinery Fundamentals	:	Stephen J Chapman.
2	Electrical machinery and Transformer	:	Irving L. Kosow

EEE 2207:Electronic Circuits II **Credit Hours: 3.00**

Course Content

Operational amplifiers (Op-Amp): properties of ideal Op-Amps, non-inverting and inverting amplifiers, inverting integrators, differentiator, weighted summer and other applications of Op-Amp circuits, effects of finite open loop gain and bandwidth on circuit performance, logic signal operation of Op-Amp, DC imperfections**.**
General purpose Op-Amp: DC analysis, small-signal analysis of different stages, gain and frequency response of 741 Op-Amp. Negative feedback: properties, basic topologies, feedback amplifiers with different topologies, stability, frequency compensation.
Active filters: Different types of filters and specifications, transfer functions, realization of first and second order low, high and band pass filters using Op-Amps.

Signal generators: Basic principle of sinusoidal oscillation, Op-Amp RC oscillators, and LC and crystal oscillators.
Power Amplifiers: Classification of output stages, class A, B and AB output stages.
Frequency response of amplifiers: Amplifier transfer function, poles, zeros and bode plots, techniques of determining 3 dB frequencies of amplifier circuits, frequency response of single-stage and cascade amplifiers, and frequency response of differential amplifiers.

Recommended Books

1	Operational Amplifiers and Linear Integrated Circuit	:	Robert F. Coughlin and Frederic R. Driscoll
2	Integrated Electronics	:	Jacob Millman and Halkias
3	Microelectronic Circuits Theory and Applications	:	Adel S. Sedra and Kenneth C. Smith
4	Op amps and linear integrated circuits	:	Ramakant A Gayakwad

EEE 2208:Electronic Circuits II Sessional **Credit Hours: 1.50**

Course Content

In this course students will perform experiments to verify practically the theories and concepts learned in EEE 2101. They will also perform simulation based on the theory course using simulation software like Pspice, MATLAB etc.

Recommended Book

1	Spices for Circuits and Electronics Using Pspice	:	MD. H. Rashid; Prentice Hall of India Private Ltd.

EEE 2211: Numerical Methods **Credit Hours: 3.00**

Course Content

Basic concepts of errors in numerical computation: Approximation and round-off errors, truncation errors and the Taylor series, error propagation.
Roots of non-linear algebraic and transcendental equations: Bracketing method -bisection method and false-position method; Open method - Fixed point iteration, the Newton- Raphson method, the Secant method, Brent's method, finding multiple roots, systems of non-linear equations.
Roots of polynomials: Muller's method and Baristow's Method.
Numerical solution of algebraic equations: Gauss elimination method, LU decomposition and matrix inversion and Gauss Seidel method.
Curve fitting: Least Square Regression, Interpolation and Fourier approximation. Numerical integration and differentiation.
Numerical solution of ordinary differential equations: Euler's method and Runge-Kutta Methods. Numerical solution of partial differential equations: Finite difference (FD) methods, numerical stability, implicit FD method. Introduction to numerical optimization. Application of the numerical techniques in solving Electrical and Electronic Engineering problems.

Recommended Books

1	Numerical Methods	:	Robert W. Hornbeck
2	Numerical Methods	:	E Balagurusamy

EEE 2212:Numerical Methods Sessional **Credit Hours: 1.50**

Course Content

Laboratory on numerical techniques using computer solution of differentiation and integration problems, transcendental equations, linear and non-linear differential equations and partial differential equations. Students will perform experiments to verify practically the theories and concepts learned in EEE 2211.

Recommended Books

1 Numerical Methods **:** Robert W. Hornbeck

EEE 3103:Digital Electronics **Credit Hours: 3.00**

Course Content

Introduction to number systems and codes.

Analysis and synthesis of digital logic circuits: Basic logic functions, Boolean algebra, combinational logic design, minimization of combinational logic.

Implementation of basic static logic gates in CMOS and Bi-CMOS: DC characteristics, noise margin, and power dissipation. Power optimization of basic gates and combinational logic circuits.

Modular combinational circuit design: Pass transistor, pass gates, multiplexer, de-multiplexer and their implementation in CMOS, decoder, encoder, comparators, binary arithmetic elements and ALU design.

Programmable logic devices: Logic arrays, field programmable logic arrays, and programmable read-only memory.

Sequential circuits: Different types of latches, flip-flops and their design using ASM approach, timing analysis and power optimization of sequential circuits.

Modular sequential logic circuit design: shift registers, counters, and their applications.

Recommended Books

1 Digital Logic and Computer Design : M Morris Mano; Prentice Hall of India Private Ltd.
2 Digital Fundamentals : Thomas L Floyd; Prentice Hall International, Inc.
3 Pulse, Digital and Switching Waveform : Jacob Millman & Herbert Taub; Tata McGraw- Hill.

EEE 3104:Digital Electronics Sessional **Credit Hours: 1.50**

Course Content

This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in EEE 3103. In the second part, students will design simple systems using the principles learned in EEE 3103.

Recommended Books:

1 Digital Logic and Computer Design : M Morris Mano; Prentice Hall of India Private Ltd.
2 Digital Fundamentals : Thomas L Floyd; Prentice Hall International, Inc.
3 Pulse, Digital and Switching waveform : Jacob Millman & Herbert Taub; Tata McGraw- Hill.

EEE 3105:Power System I **Credit Hours: 3.00**

Course Content

Per unit system: Equivalent reactance network of a three phase power system, numerical problems; Symmetrical fault analysis: Short circuit current and MVA calculations, fault levels, application of series reactors, numerical problems; Symmetrical component theory: Symmetrical component transformation, positive, negative and zero sequence components, voltages, currents and impedances.

Sequence networks: Positive, negative and zero sequence networks, numerical problems; Unsymmetrical fault analysis: LG, LL, LLG faults with and without fault impedance, numerical problems.

Performance of Short, Medium and Long Length Transmission Lines : Classification of Transmission Lines- Short, medium and Long line and their model representations- Nominal-T, Nominal- Pie and A,B,C,D Constants for symmetrical and Asymmetrical Networks, Numerical Problems. Mathematical Solutions to estimate regulation and efficiency of all types of lines-Numerical Problems. Long Transmission Line-Rigorous Solution, equivalent of A,B,C,D constants, Interpretation of Long Line Equations, Incident, Reflected and Refracted Waves-Surge Impedance and SIL of Long Lines, Wave Length and Velocity of Propagation of Waves-Representation of Long Lines- Equivalent Pie network models(numerical problems)

Load flows studies: Necessity of power flow studies, data for power flow studies, derivation of static load flow equations; Load flow solutions using Gauss Seidel method: Acceleration factor, load flow solution with and without PV buses, algorithm and flowchart; Numerical load flow solution for simple power systems (Max. 3 buses): Determination of bus voltages, injected active and reactive powers (Sample one iteration only) and finding line flows / losses for the given bus voltages; Newton-Raphson method in rectangular and polar coordinates form: Load flow solution with or without PV busses derivation of Jacobian elements, algorithm and flowchart, decoupled and fast decoupled methods, comparison of different methods, DC load flow study.

Network matrices: Definitions, bus impedance matrix, Y bus formation by direct and singular transformation methods, numerical problems; Formation of Z Bus: Partial network, algorithm for the modification of Z bus matrix for addition of element from a new bus to reference bus, addition of element from a new bus to an old bus, addition of element between an old bus to reference bus and addition of element between two old busses (Derivations and Numerical Problems), modification of Z bus for the changes in network (Numerical Problems)

Recommended Books

1	Elements of Power System Analysis	:	William D. Stevenson, Jr.
2	Power System Analysis	:	J. J. Grainger and W. D. Stevenson, Jr.
3	Electrical Power System	:	Ashfaq Husain

EEE 3106:Power System I Sessional **Credit Hours: 1.50**

Course Content

This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in EEE 3105. In the second part, students will analyze and design simple systems using the principles learned in EEE 3105.

Recommended Books

1	Elements of Power System Analysis	:	William D. Stevenson, Jr.
2	Power System Analysis	:	J. J. Grainger and W. D. Stevenson, Jr.
3	Electrical Power System	:	Ashfaq Husain

EEE 3109:Communication System I **Credit Hours: 3.00**

Course Content

Overview of Communication Systems: Basic principles, fundamental elements, system limitations, message source, bandwidth requirements, Transmission types- base-band transmission, carrier transmission; transmission media types, bandwidth, and transmission capacity.

Noise: Sources of noise, characteristics of various types of noise and signal to noise ratio.

Analog Modulation and Demodulation: Amplitude modulation (AM)- introduction, DSB, SSB, VSB, quadrature; spectral analysis of each type, envelope, and synchronous detection; angle modulation- instantaneous frequency, frequency modulation (FM) and phase modulation (PM), spectral analysis, demodulation of FM and PM.

Sampling- sampling theorem, Nyquist criterion, aliasing, instantaneous and natural sampling, flat-topped sampling; message reconstruction from its samples, PAM, PCM, quantization noise, channel noise, SNR, robust quantization, differential PCM, delta modulation (DM)- principle, adaptive DM.

Digital Communication: Baseband digital transmission, Limitations, Channels for digital communication, AWGN channel model, bit error rate of a baseband transmission system, channel capacity theorem, channel coding theorem.

Radio System: Radio Transmitter- classification, elements of AM, FM and SSB transmitter, master oscillator, mixer, RF power amplifier, pre-emphasis circuits, Radio Receiver- classification, elements of AM, FM and SSB receiver, AGC, AFC, de-emphasis circuits, noise limiter, cross modulation, Design of radio transmitter and receiver circuits.

Recommended Books

1	Modern Digital and Analog Communication System	:	B. P. Lathi
2	Digital Communication Systems	:	Simon Haykin
3	Radio Engineering	:	G. K. Mathur

EEE 3110:Communication System I Sessional **Credit Hours: 0.75**

Course Content

In this course, students will perform experiments to practically verify the theories learned in the theory course EEE 3109.

Recommended Books

1	Modern Digital and Analog Communication System	:	B. P. Lathi
2	Electronic Communication Systems	:	Kennedy and Davis
3	Digital Communication Systems	:	Simon Haykin

EEE 3113:Electrical Measurement, Instrumentation and Sensors Credit Hours: 3.00

Course Content

Introduction: Methods of measurement. Statistical method applied to field of measurement and classification of error, normal law of error, guarantee of error, error analysis and calibration.
Measuring instruments: Classification of measuring instruments, deflecting, damping and control torques, types of errors, ammeter and voltmeter: PMMC, MI instruments, expression for deflection and control torque, errors and compensation, extension of range using shunts and series resistances; Electro static voltmeter, electro dynamic type, attracted type, disc type, extension of range of ES voltmeters..
Potentiometers and Instrument transformers: Principle and operation of Crompton potentiometer, standardization, measurement of unknown resistance, current, voltage; AC potentiometers: polar and coordinate type, standardization, applications; CT and PT, ratio and phase angle error.
Measurement of Power: Single phase dynamometer type wattmeter, LPF and UPF, extension of range of wattmeter by using instrument transformers.
Measurement of Energy: Single phase induction type energy meter, three phase energy meter.
Measurement of Resistance, Inductance and Capacitance: Methods of measuring low, medium, high resistance, Wheatstone bridge, carry foster, Kelvin's double bridge, loss of charge method; Measurement of Inductance: Maxwell's bridge, hay's bridge , Anderson's bridge, Owen's bridge; Measurement of Capacitance: De Sauty's bridge, Wein's bridge, Schering bridge
Transducers: Definition of transducers, classification of transducers, advantages of electrical transducers, characteristics and choice of transducers, principle of operation of LVDT and capacitor transducers, LVDT applications, strain gauge and its principle of operation, gauge factor, thermistors, thermocouples, piezo-electric transducers, photovoltaic, photo conductive cells, photo diodes; Cathode ray oscilloscope: cathode ray tube, CRO probes, applications of CRO, measurement of phase and frequency, Lissajous patterns.
Magnetic measurements: Flux meter, Flux and Flux density measurement. Determination of iron losses and their separation, ballistic galvanometers, flux meter, high voltage measurement.

Recommended Books

1	A Course in Electrical and Electronic Measurements and Instrumentation	:	A. K. Sawhney
2	Measurement and Instrumentation	:	Alan Morris

EEE 3114:
Electrical Measurement, Instrumentation and Sensors Sessional Credit Hours: 1.50

Course Content

In this course, students will get hands-on experience in electrical and electronic measurement system components. They will observe the uses of electrical and electronic measurement system components practically.

Recommended Books

1	A Course in Electrical and Electronic Measurements and Instrumentation	:	A. K. Sawhney
2	Measurement and Instrumentation Principle	:	Alan Morris

EEE 3117:Engineering Electromagnetic **Credit Hours: 3.00**

Course Content

Static Electric Field: Postulates of electrostatics, Coulomb's law for discrete and continuously distributed charges, Gauss's law and its application, electric potential due to charge distribution, conductors and dielectrics in static electric field, flux density - boundary conditions, capacitance - electrostatic energy and forces, energy in semesters of field equations, capacitance calculation of different geometries, boundary value problems – Poisson's and Laplace's equations in different co-ordinate systems. Steady electric current: Ohm's law, continuity equation, Joule's law, resistance calculation.

Static Magnetic Field: Postulates of magnetostatics, Biot-Savart's law, Ampere's law and applications, vector magnetic potential, magnetic dipole, magnetization, magnetic field intensity and relative permeability, boundary conditions for magnetic field, magnetic energy, magnetic forces, torque and inductance of different geometries.

Time Varying Fields and Maxwell's Equations: Faraday's law of electromagnetic induction, Maxwell's equations - differential and integral forms, boundary conditions, potential functions, time harmonic fields.

Plane Electromagnetic Wave: Poynting's theorem and EM lower flow, Plane wave in loss less media - Doppler effect, transverse electromagnetic wave, polarization of plane wave, plane wave in lossy media – low-loss dielectrics, good conductors, group velocity, instantaneous and average power densities, normal and oblique incidence of plane waves at plane boundaries for different polarization.

Recommended Books

1	Fundamentals of engineering Electromagnetics	:	David K. Cheng
2	Elements of Electromagnetics, 5th Edition, Oxford University Press, 2010	:	Matthew N. O. Sadiku
3	Engineering Electromagnetics, 8th Edition, McGraw-Hill, 2012	:	Hayt William Hart and Buck John A

EEE 3201:Control System I **Credit Hours: 3.00**

Course Content

Introduction to control systems: Conventional control system, steady state response to step, ramp, and parabolic inputs, transient response, poles and zeros, frequency response from pole-zero diagram,

Linear system models: Transfer function, block diagram and signal flow graph (SFG).

State variables: SFG to state variables, transfer function to state variable and state variable to transfer function.

Feedback control system: Closed loop systems, parameter sensitivity, transient characteristics of control systems, effect of additional pole and zero on the system response and system types and steady state error. Routh's stability criterion.

Analysis of feedback control system: Root locus method and frequency response method.

Design of feedback control system: Controllability and observability, root locus, frequency response and state variable methods.
Digital control systems: introduction, sampled data systems, stability analysis in Z-domain.

Recommended Books

1	Control Systems Engineering	:	Norman Nise
2	Modern Control Engineering	:	Katsuhiko Ogata
3	Modern Control Systems	:	Richard C. Dorf

EEE 3202:Control System I Sessional **Credit Hours: 1.00**

Course Content

This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in EEE 3201. In the second part, students will design simple systems using the principles learned in EEE 3201.

Recommended Books

1	Control Systems Engineering	:	Norman S. Nise
2	Modern Control Systems	:	Richard C. Dorf

EEE 3209:Communication System II **Credit Hours: 3.00**

Course Content

Digital Modulation Techniques: Binary modulation techniques: ASK, PSK, and FSK, Detection of ASK, PSK, and FSK, Quadrature modulation techniques, M-ary modulation techniques, power spectra, effect of inter-symbol interference.
Detection and Estimation: Model of digital communication system, detection of signals in noise, probability of error, correlation receiver, matched filter receiver. Estimation: MLE, Weiner filters, Adaptive filters, linear prediction. Bit error rate calculation of a digital link, digital link design.
Error Correction Coding: Block codes, cyclic codes, systematic and nonsystematic cyclic codes, convolutional codes, Trellis codes, decoding techniques. Multiplexing Techniques: FDM, TDM, SDH, PDH, SONET, WDM, SONET over WDM.
Multiple Access Techniques: FDMA, TDMA, CDMA and SDMA. Introduction to 2G and 3G mobile communication systems.
Telephone Networks: Subscriber loop systems, switching hierarchy and routing, Transmission plan, Transmission systems, numbering plan, charging plan, signaling techniques, In channel signaling, Common channel signaling.
Switching System: Strowger and Crossbar switching systems, Stored program control, Software architecture, Application software, Enhanced services. Space division switching, time division switching, blocking probability and multistage switching, and digital memory switch.
Traffic Engineering: Traffic characterization, Grade of services and blocking probability, Modeling switching systems, Blocking models and loss estimates, delay system and queuing. Introduction to optical fiber and Satellite communications.

Recommended Books

1	Modern Digital and Analog Communication System	:	B. P. Lathi

2	Digital Communication Systems	:	Simon Haykin

EEE 3210:Communication System II Sessional **Credit Hours: 0.75**

Course Content

In this course students will perform experiments to verify practically the theories and concepts learned in EEE 3209.

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Recommended Books

1	Modern Digital and Analog Communication System	:	B. P. Lathi
2	Digital Communication Systems	:	Simon Haykin

EEE 3211:Digital signal Processing I **Credit Hours: 3.00**

Course Content

Introduction to digital signal processing (DSP): Discrete-time signals and systems, analog to digital conversion, impulse response, finite impulse response (FIR) and infinite impulse response (IIR) of discrete-time systems, difference equation, convolution, transient and steady state response.

Discrete transformations: Discrete Fourier series, discrete-time Fourier series, discrete Fourier transform (DFT) and properties, fast Fourier transform (FFT), inverse fast Fourier transform (IFFT).

Z transformation: Properties, transfer function, poles and zeros and inverse Z transform.

Correlation: Circular convolution, auto-correlation and cross correlation.

Digital Filters: FIR filters - linear phase filters, specifications, design using window, optimal and frequency sampling methods, IIR filters – specifications, design using impulse invariant, bi-linear Z transformation, least-square methods and finite precision effects.

Recommended Books

1	Digital Signal Processing: Principles, Algorithms and Applications	**:**	John G Proakis, Dimitris K Manolakis
2	Digital Signal Processing	**:**	Emmanuel C. Ifeachor & Barrie w. Servis
3	Signal and System (Continuous & Discrete)	**:**	Rodger E. Ziemer, W. H. Tranter & D. R. Fannin

EEE 3212:Digital signal Processing I Sessional **Credit Hours: 1.50**

Course Content

This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in EEE 3211. In the second part, students will design simple systems using the principles learned in EEE 3211.

Recommended Books

1	Digital Signal Processing: Principles, Algorithms and Applications	**:**	Proakis & Manolakis.
2	Digital Signal Processing using MATLAB	**:**	Ingle & Proakis.

EEE 3217:VLSI I **Credit Hours: 3.00**

Course Content

VLSI technology: Top down design approach, technology trends and design styles.
Review of MOS transistor theory: Introduction to microelectronics and MOS technology, Threshold voltage, body effect, I-V equations and characteristics, latch-up problems, NMOS inverter, CMOS inverter, pass-transistor and transmission gates.
CMOS circuit characteristics and performance estimation: Resistance, capacitance, rise and fall times, delay, gate transistor sizing and power consumption.
CMOS circuit and logic design: Rules of layout design and physical design of simple logic gates.
CMOS subsystem design: Adders, multiplier and memory system, arithmetic logic unit, programmable logic arrays, I/O systems, VLSI testing.

Recommended Books

1	Basic VLSI Design	:	Douglas A. Pucknell
2	CMOS VLSI Design - A Circuits and System Perspective	:	N. H. E. Weste and D. Harris
3	Fundamentals of Microelectronics	:	Behzad Razavi

EEE 3218:VLSI I Sessional **Credit Hours: 0.75**

Course Content

This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in EEE 3217. In the second part, students will design simple systems using the principles learned in EEE 3217.

Recommended Books

1	Analysis and Design of Analog Integrated Circuits	:	Gray and Meyer
2	CMOS: Circuit Design, Layout, and Simulation	:	R. Jacob Baker; Harry W. Li; David E. Boyce

EEE 3230:Industrial Training **Credit Hours: 1.00**

Course Content

Intensive training in a particular industry as arranged by the student. It will be conducted at any convenient time after the semester end exam of 3rd Year 2nd Semester for duration of 6 weeks as applicable or decided by the department. Completion of industrial attachment is mandatory for issuing of B.Sc. degree.

EEE 3100 / 3200: Integrated Design Project I/II **Credit Hours: 1.50**

Course Content

This course is the first part to capstone project. The course aims to synergies all the basic engineering knowledge gained previously to solve real electrical engineering problems in an

integrated and comprehensive manner. Students will be first exposed to the importance of good design concepts that considers important characteristics considering public health and safety, society and culture, environment and sustainability, authorities' requirements, as well as project cost effectiveness. Students will work in groups to observe existing project to evaluate the pros and cons of project characteristics. Electrical engineering is an engineering stream that comprises study and understanding about electricity and electronics. The main work of electrical engineers is to distribute energy for different devices. They have to use their knowledge and skills of electrical engineering for solving various technical problems. Students will be capable of doing on some specified electrical devices or products like developing GPS systems, airline navigation systems; designing power generating and transmitting system like a power plant of a wind farmhouse, and so on. Preparation and presentation of report will be done at the end of the course by the students.

Recommended Books

1.	Power System Analysis	:	J. J. Grainger and W. D. Stevenson, Jr
2.	Modern Power System Planning	:	X. Wang and J. R. Mc Donald
3.	The Algebra of Modern Variable	:	M.D.Springer
4.	High Voltage engineering	:	M. Khalifa; Dekker.
5.	Op Amps & Linear Integrated Circuits	:	James M. Fiore; Delmar Thomson Learing.
6.	Physics of Semiconductor Devices	:	S M Sze
7.	Microwave Devices and Circuits	:	Samuel Y. Liao; Prentice Hall of India
8.	Fiber Optic Communication System	:	Gerd Keiser; McGraw-Hill International
9.	Digital Communications	:	Simon Haykin; McGraw Hill International

EEE 4000:Project/Thesis **Credit Hours: 6.00**

Course Contents

Students may choose to write alone or in groups of up to 3 students.

Types of thesis:

Students can choose topics containing theoretical, empirical and/or practical aspects. But irrespective of the topic chosen, the use of relevant theory and literature is fundamental to the thesis.

An empirical paper: The idea is to gather knowledge on a specific topic and to relate theory to empirical observations, e.g. by using existing data, by using questionnaires or experiments.

A case study: A case study approach involves an analysis of a specific occurrence or process in an actual company or another type of organization. The purpose of a case study is to provide descriptions, analyses and suggested solutions to problems in relation to the case in hand. Case studies will involve the use of quantitative and/or qualitative methods for data collection.

A theoretical paper: This type of thesis builds on a theoretical model or a generic problem. Often a theoretical thesis is based on existing literature studies in which a theoretical problem is analyzed. This type of thesis is the least common.

No type of thesis is superior to others and no topics guarantee a high grade. The grade is based solely on whether the topic is thoroughly analyzed, the results clearly presented and whether you are able to demonstrate your knowledge of current theories and analyses, competent application of methods as well as independent critical judgment.

EEE 4101: Biomedical Signals and Systems **Credit Hours: 3.00**

Course Content

Human body: Cells and physiological systems, bioelectric potential, bio-potential electrodes and amplifiers, blood pressure, flow, volume and sound, EEG, ECG, EMG, phonocardiogram, vector cardiogram, interpretation of bio-signals, Noise in bio-signals, transducers, amplifiers and filters, measurement and detection of blood pressure, plethysmograph and electromagnetic flow meter, measurement of respiratory volumes and flow, related devices. X-ray.

Tomography: positron emission tomography and computed tomography, magnetic resonance imaging (MRI), ultra sonogram, patient monitoring system and medical telemetry.

Therapeutic devices: cardiac pacemakers and defibrillators, electrical safety in bioinstrumentations and sensing.

Recommended Books

1	Biomedical Instrumentation and Measurements	:	Leslie Cromwell
2	Medical Instrumentation: Application and Design	:	John G. Webster

EEE 4102: Biomedical Signals and Systems Sessional **Credit Hours: 0.75**

Course Content

This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in EEE 4101. In the second part, students will design simple systems using the principles learned in EEE 4101.

Recommended Books

1.	Biomedical Devices and Systems	:	Joseph D.Bronzino
2.	Design and Development of Medical Electronic Instrumentation	:	David Prutchi and Michael Norris
3.	Biomedical Signal Analysis	:	Rangaraj M. Rangayyan

EEE 4107: Microprocessor and Embedded System **Credit Hours: 3.00**

Course Content

Basic Computer: Basic components of a computer system, Simple-As-Possible (SAP) computer: SAP-1, selected concepts from SAP-2 and SAP-3 (jump, call, return, stack, push and pop). Evolution of microprocessors.

8086 Microprocessor: Introduction to Intel 8086 microprocessor, features, architecture, Minimum mode operation of 8086 microprocessor: system timing diagrams of read and write cycles, memory banks, design of decoders for RAM, ROM and PORT.

8086 Assembly Language Programming: basic instructions, logic, shift and rotate instructions, addressing modes, stack management and procedures, advanced arithmetic

instructions for multiplication and division, instructions for BCD and double precision numbers, introduction to 8086 programming with C language.

Hardware Interfacing with 8086 microprocessor: Introduction to some available microprocessor peripherals IC's and their applications such as 8251, 8253, 8254, 8255, 8257, 8259, 8279, programmable interrupt controller, programmable timer, serial communication interface, keyboard and display interface (LED, 7 segment, dot matrix and LCD).

Embedded System: Introduction to embedded system, categories and applications, Major components in a typical embedded system

Microcontrollers: Basic structures of microcontrollers, basic features, types of microcontrollers, PIC, CISC and RISC microcontrollers, basic features and architecture, memory interfacing, digital I/O, timers,

Special Microcontroller: Introduction to Arduino, Raspberry Pi, IoT.

Recommended Books

1	Microprocessor Architecture, Programming and Applications	:	R. Gaonkar
2	Microprocessor Hardware Interfacing and Application	:	Barry B. Brey
3	Microprocessors and Interfacing	:	Douglas V. Hall
4	Microprocessor and Microprocessor-based System Design	:	M. Rafiquzzaman

EEE 4108: Microprocessor and Embedded System Sessional **Credit Hours: 0.75**

Course Contents

Practical System orientation on basis of the course EEE-4107: Intel 8086 microprocessor: architecture, addressing modes, instruction sets, assembly language programming, system design and interrupt. Interfacing: programmable peripheral interface, programmable timer, serial communication interface, programmable interrupt controller, direct memory access, keyboard, display device and other I/O device interface. Introduction to microcontrollers.

Recommended Books

1	Microprocessor Architecture, Programming and Applications	:	R. Gaonkar
2	Microprocessor Hardware Interfacing and Application	:	Barry B. Brey
3	Microprocessors and Interfacing	:	Douglas V. Hall
4	Microprocessor and Microprocessor-based System Design	:	M. Rafiquzzaman

EEE 4122:Electrical Service Design & CAD Sessional **Credit Hours: 0.75**

Course Content

Wiring system design, drafting, and estimation. Design for illumination and lighting. Electrical installations system design: substation, BBT and protection, air-conditioning, heating and lifts. Design AC to DC converter. Design for intercom, public address systems, telephone system and LAN. Design of security systems including CCTV, fire alarm, smoke detector, burglar alarm, and sprinkler system. A design problem on a multi-storied building.

Recommended Books

1	Design of Electrical Services for Buildings	:	Barrie Rigby
2	Electrical Wiring Estimating & Costing	:	S L Uppal

EEE 4201:Solid State Devices **Credit Hours: 3.00**

Course Content

Semiconductors in equilibrium: Energy bands, intrinsic and extrinsic semiconductors, Fermi levels, electron and hole concentrations, temperature dependence of carrier concentrations and invariance of Fermi level.

Carrier transport processes and excess carriers: Drift and diffusion, generation and recombination of excess carriers, built-in-field, recombination-generation SRH formula, surface recombination, Einstein relations, continuity and diffusion equations for holes and electrons and quasi-Fermi level.

PN junction: Basic structure, equilibrium conditions, contact potential, equilibrium Fermi level, space charge, non-equilibrium condition, forward and reverse bias, carrier injection, minority and majority carrier currents, transient and AC conditions, time variation of stored charge, reverse recovery transient and capacitance.

Bipolar Junction Transistor: Basic principle of pnp and npn transistors, emitter efficiency, base transport factor and current gain, diffusion equation in the base, terminal currents, coupled-diode model and charge control analysis, Ebers-Moll model and circuit synthesis. BJT non-ideal effects; Hetero-junction transistors.

Metal-semiconductor junction: Energy band diagram of metal semiconductor junctions, rectifying and Ohmic contacts.

MOS structure: MOS capacitor, energy band diagrams and flat band voltage, threshold voltage and control of threshold voltage, static CV characteristics, qualitative theory of MOSFET operation, body effect and current-voltage relationship of a MOSFET.

Non-ideal characteristics of MOSFET: channel-length modulation and short channel effects in MOSFETs. MOS scaling.

Introduction to Multi-gate FET architecture: Double gate MOSFET, FinFET, Surrounding gate FET, high-K dielectric FETs.

Recommended Books

1	Semiconductor Physics and Devices	:	Donald A. Neamen
2	Solid Sate Electronics	:	BEN G. Streetman
3	Principles of Electronic Materials and Devices	:	S. O. Kasap

EEE 4273:Power Electronics **Credit Hours: 3.00**

Course Content

Power Semiconductor Devices and Commutation Circuits: Power semiconductor devices and commutation circuits: Thyristors, principle of operation of silicon controlled rectifiers (SCR), bipolar junction transistor (BJT), power metal oxide semiconductor filed effect transistor (MOSFET), power insulated gate bipolar transistor (IGBT), gate turnoff thyristor (GTO) and characteristics, turn on and turnoff methods, dynamic characteristics of SCR, two transistor analogy, unijunction transistor firing circuit, series and parallel operation of SCR's, design of

snubber circuit; Specifications and ratings: Ratings of SCR, BJT and IGBT, line commutation and forced commutation circuits, numerical problems.

Single Phase and Three Phase Controlled Rectifiers: AC - DC converters: Phase control technique, single phase line commutated converters, midpoint and bridge connections, half controlled converters and semi converters with R, RL and RLC loads, derivation of average load voltage and current, active and reactive power inputs to the converters without and with freewheeling diode, numerical problems; Fully controlled converters: Midpoint and bridge connections with R, RL loads and RLC load, derivation of average load voltage and current, line commutated inverters, active and reactive power inputs to the converters without and with freewheeling diode, derivation of load voltage and current, numerical problems; Three phase converters: Three pulse and six pulse converters, midpoint and bridge connections, average load voltage with R and RL loads, effect of source inductance, operation of single phase and three phase dual converters, numerical problems.

AC Voltage Controllers and Cycloconverters: AC - AC controllers: Introduction, single phase two SCR's in anti-parallel, with R and RL loads, modes of operation of triac, triac with R and RL loads, derivation of RMS load voltage, current and power factor, wave forms, numerical problems;

Cycloconverters: Principle of operation of single phase midpoint and bridge type cycloconverters with resistive and inductive loads, continuous and discontinuous mode of operation.

DC– DC Converters: DC - DC converters: Principle of operation of choppers, time ratio control and current limit control strategies, types of choppers, derivation of load voltage and currents with R, RL and RLC loads, AC chopper, problems; Switched mode regulators: Study of buck, boost and buck - boost regulators, Cuk regulators

Inverters: DC - AC converters: Single phase inverter, basic series inverter, parallel inverter, operation and waveforms, voltage source inverter (VSI), three phase inverters 180, 120 degrees conduction modes of operation, voltage control techniques for inverters, pulse width modulation techniques, reduction of harmonics, current source inverter (CSI) with ideal switches, capacitor commutated type CSI, numerical problems.

Recommended Books

1	Power Electronics: Device, Principles and Application	:	Muhammad H Rashid
2	Power Electronics: Converters, Applications, and Design	:	Ned Mohan, Tore M Undeland, William P Robbins

EEE 4274:Power Electronics Sessional **Credit Hours: 1.50**

Course Content

Power semiconductor switches, SCR operation in AC circuit, switching losses, Switching regulator circuits for controlling DC-DC converters, Switching regulator circuits for controlling single phase square wave inverter, DC-DC converter circuits: Buck, Boost, Buck-Boost, Cuk. Single phase inverter circuits: Square wave push pull and half bridge voltage source inverters. Operation of single and three phase uncontrolled rectifiers.

Recommended Books

1	Power Electronics: Device, Principles and Application	:	Muhammad H Rashid

Chapter 6

Course Offered by Other Departments to EEE Students

6.1 Department of Computer Science and Engineering

CSE 1209: Computer Programming	**Credit Hours: 3.00**

Course Content

Introduction to Digital Computer: computer generations, software and hardware; programming languages and their classifications, basic concepts of assembler, compiler, interpreter, algorithms and flow charts;

Introduction to C Programming: History and characteristics of C, identifiers and keywords, data types, constants, variables, statements, symbolic constant, operators and expressions.

Control Statements: Decision making and Branching- If and if… else statements, nested if, switch statement; else if ladder, Looping- while, do…while and for looping statements, jumps in loops, goto statement, break and continue statement.

Array and Pointers: one dimensional and two dimensional array, processing an array, passing arrays to functions, multidimensional array, pointer declarations, operations on pointers, pointers and arrays, pointers and functions, linked list and dynamic memory allocation.

Function: library functions and user defined functions, defining and accessing functions, function prototypes, passing arguments to a function, scope rules, nesting and recursions, passing array elements to a function.

String Operations: declaring and initializing string variables, string I/O operations, standard library string functions, two dimensional array of characters, array of pointers to string and its limitations.

Structure and Unions: declaring and processing a structure, array and structure, structure and pointers, passing structures to functions, self-referential structure, Union. File: opening and closing a file, creating a file, processing a file, I/O file handling.

Basics of Object Oriented Programming: Introduction to C++, classes and objects; encapsulation, inheritance, constructors and destructors, operator and function overloading, polymorphism;

Recommended Books

1	Programming with C	**:**	John Hubbard; Schaum's Outlines
2	Programming with C++	**:**	John Hubbard; McGraw-Hill Int. Edn

CSE 1210:Computer Programming Sessional	**Credit Hours: 1.50**

Course Content

This course consists of two parts. In the first part students will perform experiments to verify practically the theories and concepts learned in CSE 1209. In the second part students will learn program design.

Recommended Books

1	Programming with C	:	John Hubbard; Schaum"s Outlines
2	Programming with C++	:	John Hubbard; McGraw-Hill Int. Edn

6.2 Department of Civil Engineering

CE 1252:Engineering Drawing **Credit Hours: 1.50**

Course Content

This course will help the students to draw various practical aspects and learn the concepts clearly.

6.3 Department of Mechanical Engineering

ME 2163: Fundamentals of Mechanical Engineering **Credit Hours: 3.00**

Course Content

Introduction to the sources of Heat energy: Renewable and non-renewable sources and their potential.

Steam generator: Boilers and their classification; Working principle of few common and modern boiler; boiler mountings and accessories.

Heat engines: Gas turbines, diesel engines, petrol engines, Fuel, lubrication and cooling systems of I.C engines.

Energy and First law: Systems and surroundings; Conservation of energy; Different thermodynamic processes; Energy transfer as heat for a control volume.

Entropy and Second law: Reversibility and irreversibility; Definition and corollaries of second law of thermodynamics.

Entropy: its transfer and change. Characteristics of some thermodynamic cycles: Analysis of different thermodynamic cycles, vapor power cycles, Representation of various cycles on PV & TS planes.

Basic concepts of refrigeration systems: Vapor compression refrigeration, Absorption refrigeration, cop, refrigerants and their classifications and properties.

Air conditioning: Introduction, objectives and major components of air conditioning systems; Humidity; Dew point.

Recommended Books

1	A Text Book of Thermal Engineering	:	R. S. Khurmi & J. K. Gupta
2	Basic Mechanical Engineering	:	R. K. Rajput

ME 2164:Fundamentals of Mechanical Engineering Sessional **Credit Hours: 1.00**

Course Content

This course will help the students to draw various practical aspects and learn the concepts clearly. After all, students will perform experiments to verify practically the theories and concepts learned in ME 2163.

Recommended Books

1	A Text Book of Thermal Engineering	:	R. S. Khurmi & J. K. Gupta
2	Basic Mechanical Engineering	:	R. K. Rajput

ME 4193:Industrial Management **Credit Hours: 3.00**

Course Content

Cost management: Elements of cost of products, cost centers and allocation of overhead costs.
Management accounting: marginal costing, standard costing, cost planning and control, budget and budgetary control;
Development and planning process: Annual development plan; National budget.
Financial management: Objectives, strategy, financing, performance analysis of enterprises, investment appraisal, criteria of investment.
Personnel management: Importance, scope, need hierarchy, motivation; Defense mechanism; Productivity and satisfaction; Leadership; Group dynamics; Job evaluation and merit rating;
Personnel development: hiring, training, wage systems.
Project Management: Project Lifecycle, Project Scheduling, Project Budgeting, Project Monitoring

Recommended Books

1	Management	:	Jams A. F. Stoner, R. Edward Freeman, Daniel R. Gilbert
2	Managerial Accounting	:	Ray H. Garrison, Eric W. Noreen

6.4 Department of Science and Humanities

Physics

PHY 1111:Physics **Credit Hours: 4.00**

Course Content

Waves and oscillations: Differential equation of simple harmonic oscillator, total energy and average energy, spring mass system; two body oscillation, reduced mass, damped oscillation, forced oscillation, group and phase velocities.
Optics: Theories of light; Interference of light: Young's double slit experiment, displacement of fringes and its uses, Fresnel bi-prism, interference in thin films, Newton's rings, interferometers; Diffraction: Diffraction by single slit, diffraction from a circular aperture, resolving power of optical instruments, polarization: Production and analysis of polarized light, Brewster's law, Malus law, polarization by double refraction.
Electricity and Magnetism: Electric charge and Coulomb's law, Electric field, concept of electric flux and the Gauss's law- some applications of Gauss's law, Gauss's law in vector form, Electric potential, relation between electric field and electric potential, gradient, Current, Current density, the magnetic field, Ampere's law, Laws of electromagnetic induction-Maxwell's equation.
Modern Physics: photoelectric effect, Constituent of atomic nucleus, Nuclear binding energy, different types of radioactivity, radioactive decay law; Nuclear reactions, nuclear fission,

nuclear fusion, atomic power plant.

Mechanics: Kepler's law of planetary motion, introductory quantum mechanics; Wave function; Uncertainty principle, postulates, Schrodinger time independent equation, expectation value, Probability, Particle in a zero potential, calculation of energy.

Thermal Physics: The first law of thermodynamics, The second law of thermodynamics, Entropy, Thermodynamics Function, Maxwell relations.

Recommended Books

1	Physics (part II)	:	D. Halliday and R. Resnick
2	Concepts of Electricity and Magnetism	:	Hoq Rafiqullah and Roy
3	Modern Physics	:	Arthur Beiser

PHY 1112:Physics Sessional **Credit Hours: 1.50**

Course Content

Different experiments related to course PHY-1111.

Recommended Books

1	Physics (part II)	:	D. Halliday and R. Resnick
2	Concepts of Electricity and Magnetism	:	HoqRafiqullah and Roy
3	Modern Physics	:	Arthur Beiser

Chemistry

CHEM 1211:Chemistry **Credit Hours: 3.00**

Course Content

Concepts of atomic structure, Different atom models, Quantum numbers, Electronics configuration, Periodic classification of elements, Periodic properties of elements, Properties and uses of noble gases, Chemical bonding (types, properties, Lewis theory, VBT, MOT), Hybridization and shapes of molecules, Selective organic reactions such as - addition, substitution, oxidation- reduction, alkylation and polymerization, Phase rule, Phase diagram of mono component system.

Solutions and their classification, Unit expressing concentration, Colligative properties of dilute solutions, Thermo chemistry, Chemical kinetics, Chemical equilibrium, pH and buffer solutions, and Electrical properties of solution and Electro-chemical cell reactions.

Recommended Books

1	Principles of Physical Chemistry	:	Haque & Nawab; Students' Publications.
2	Fundamentals of Physical Chemistry	:	Samuel H. Maron & Jerome B. Lando; MacMillan Publishing Co., Inc., Newyork.
3	Physical Chemistry	:	P. W. Atkins; Oxford University Press.
4	Essentials of Physical Chemistry	:	B.S. Bahl & G.D. Tuli; S. Chand and Company Ltd.

CHEM 1212:Chemistry Sessional **Credit Hours: 1.00**

Course Content

Volumetric analysis: Acid-base titration, Oxidation-reduction titration: Determination of Cu, Fe and Ca content volumetrically.

Recommended Books

1	Principles of Physical Chemistry	:	Haque & Nawab; Students' Publications.
2	Fundamentals of Physical Chemistry	:	Samuel H. Maron & Jerome B. Lando; MacMillan Publishing Co., Inc., Newyork.
3	Physical Chemistry	:	P. W. Atkins; Oxford University Press.
4	Essentials of Physical Chemistry	:	B.S. Bahl & G.D. Tuli; S. Chand and Company Ltd.

Mathematics

MATH 1111:Engineering Mathematics-I **Credit Hours: 3.00**

Course Content

Differential Calculus: Limit, continuity and differentiability, successive differentiation, Leibnitz theorem, Rolle's theorem, Mean-value theorem, Taylor's theorem, expansions of functions differentiation and integration, indeterminate form, Partial differentiation, Euler's theorem, tangent and normal in Cartesian and polar coordinates, maxima and minima of functions of single variables, curvature, asymptotes.

Integral Calculus: Definition of integrations, integration by the method of substitution, integration by parts, standard integrals, definite integrals and its use in summing series, reduction and more reduction formula, Walli's formula, improper integrals, beta function and gamma function, multiple integral and its application, area, volume of solid revolution, area under a plain curve in Cartesian and polar coordinates, area of the region enclosed by two curves in Cartesian and polar coordinates, arc lengths of curves in Cartesian and polar coordinates.

Co-ordinate Geometry: Co-ordinate geometry of three dimension- System of co-ordinates, transformation of coordinates, distance between two points, section formula, projection, direction cosines, equations of planes and lines.

Recommended Books

1	A Text Book on Differential Calculus	:	Mohammad & Bhattacharjee; Students' Publication.
2	Differential Calculus	:	M. L. Khanna; JoiProkashNath and Company.
3	Differential Calculus	:	Shanti Narayan; S. Chand and Company Ltd.
4	A Text Book on Integral Calculus	:	Mohammad & Bhattacharjee; Students' Publication.

MATH 1215:Engineering Mathematics II **Credit Hours: 3.00**

Course Content

Complex Variables:

Complex number system, General functions of a complex variable, Limits and continuity of a function of complex variable and related theorems, Complex function, differentiation and the Cauchy-Riemann Equations, Convergence and uniform convergence, Line integral of a complex function, Cauchy' s Integral Formula, Lowville's Theorem, Taylors and Laurent's Theorem, Singular Residues, Cauchy's Residue Theorem.

Statistics:

Introduction. Sets and probability. Random variable and its probability distribution. Treatment of grouped sampled data. Some discrete probability distribution. Normal distribution. Sampling theory. Estimation theory. Tests of hypothesis, regression, and correlation. Analysis of variance.

Vector Analysis:

Scalars and vectors, Equality of vectors, Addition and subtraction of vectors, Multiplications of vectors by scalars, Scalar and vector product of two vectors and their geometrical interpretations, Triple and multiple products of vectors, Linear dependence and independence of vectors, Differentiation and integration of vectors together with elementary applications, definition of line, surface and volume integrals, Gradient of a scalar function, Divergence and curl of a vector function, Various formula, Integral forms of gradient, divergence and curl, Gauss's divergence theorem, Stoke's theorem and Green's theorem.

Recommended Books

1	Complex Variables	:	Frank Ayres (Schaum's Outline Series); McGraw-Hill.
2	Functions of Complex Variables	:	Dewan Abdul Kuddus; TitasPrakashani, Dhaka.
3	Functions of Complex Variables	:	Goyal and Gupta; ProgotiProkashan, Meerut.
4	Statistics and Probability	:	Spiegel (Schaum Series); McGraw-Hill.

MATH 2111:Engineering Mathematics III **Credit Hours: 3.00**

Course Content

Fourier Analysis: Real and complex form of Fourier series, Finite transform, Fourier Integral, Fourier transforms and their uses in solving boundary value problems of wave equations.

Laplace Transforms: Definition, Laplace transforms of some elementary functions, Sufficient conditions for existence of Laplace Transforms, Inverse Laplace Transforms, Laplace Transforms of derivatives. The unit step function, Periodic function, Some special theorems on Laplace Transforms, Partial fractions, Solutions of differential equations by Laplace Transforms, Evaluation of improper integrals.

Linear Algebra: Introduction to systems of linear equations, Gaussian elimination. Definition of matrices. Algebra of matrices, Transpose of a matrix and inverse of matrix. Factorization, Determinants, Quadratic forms, Matrix polynomials, Euclidean space, Linear transformation from IRn to IRm, Properties of linear transformation from IRn to IRm. Real vector spaces and subspaces. Basis and dimension. Rank and nullity. Inner product spaces. Eigenvalues and eigenvectors. Application of linear algebra to electric networks.

Recommended Books

1	An Introduction to Laplace Transforms and Fourier Series	:	P. P. G. Dyke
2	The Laplace Transform: Theory and Applications	:	Joel L. Schiff
3	Schaum's Outline of Laplace Transform	:	Murray R. Spiegel
4	Fourier and Laplace Transforms	:	R. J. Beerends

MATH 2213:Engineering Mathematics-IV **Credit Hours: 3.00**

Course Content

Formulation of Differential Equations, Degree and order of Ordinary differential equations, Solution of first order but higher degree differential equations, Solution of first order differential equations by various methods, Solution of general linear equations of second and higher orders with constant co-efficient, Solution of Homogeneous linear equations and its applications, Solution of differential equations by the methods based on the factorization of the operators, Frobenious methods, Bessel's functions, Legendre's polynomials and properties.

Introduction to Linear and non-linear first order equations, Standard forms of linear equations of higher order, Equation of second order with variable coefficients. Wave equations, Particular solutions with boundary and initial conditions, Integral surface passing through given curve; Nonlinear PDE of order One (Complete, particular, singular and general integrals), Charpit's Method, Second order PDE and classifications to canonical (standard)- parabolic, elliptic, hyperbolic solution by separation of variables, Linear PDE with constant coefficients.

Recommended Books

1	Differential Equation	:	M.D. Raisinghania
2	Differential Equation	:	Schaum's Series; McGraw-Hill.

Humanities

HUM 1153:Bengali Language and Literature **Credit Hours: 2.00**

Course Content

প্রথম খন্ড - ভাষা

১. বাংলা ধ্বনি/বাগ্ ধ্বনি (Phone/Speech Sound); বর্ণ (Letter);অক্ষর (Syllable)

২. বাংলা ধ্বনির উচ্চারণ স্থান ও রীতি (Point of Articulation & Manner of Articulation)

৩. বাংলা উচ্চারণ - প্রমিত (Standard), আঞ্চলিক (Dialectal), বৈচিত্র (Variation)

৪. অপিনিহিত, অভিশ্রুতি, স্বরসঙ্গতি, শ্বাসাঘাত (Stress accent), স্বরভঙ্গি/ স্বরতরঙ্গ (Intonation);

৫. বাংলা ও ইংরেজির তুলনা

৬. বাংলা লিখন দক্ষতা : সাধু/চলিত রীতি। বিরাম চিহ্ন প্রয়োগ। প্রমিত বাংলা বানানের নিয়ম (বাংলা একাডেমি)

৭. ব্যবহারিক বাংলা : সংক্ষিপ্ত আলোচনা

একুশে ফেব্রুয়ারী, মুক্তিযুদ্ধ, বাংলাভাষা, বিশ্বায়ন,বাংলার উৎসব,ষড়ঋতু,বাংলা নববর্ষ, আধুনিক তথ্য-প্রযুক্তি,বাংলার লোক সংস্কৃতি, মানবতা ও নৈতিকতা।

দ্বিতীয় খন্ড - সাহিত্য

কবিতা

১. আবদুল হাকিম - নূরনামা
২. মাইকেল মধূসুদন দত্ত - বঙ্গভাষা
৩. লালন সাঁই - খাঁচার ভেতর অচিন পাখি
৪. রবীন্দ্রনাথ ঠাকুর - নির্ঝরের স্বপ্নভঙ্গ
৫. কাজী নজরুল ইসলাম - আজ সৃষ্টি -সুখের উল্লাসে
৬. জীবনানন্দ দাস - রূপসী বাংলা
৭. হাসান হাফিজুর রহমান - অমর একুশে
৮. আলাউদ্দিন আল আজাদ - স্মৃতি স্তম্ভ
৯. শামসুর রাহমান - তোমাকে পাওয়ার জন্য হে স্বাধীনতা
১০. সৈয়দ শামসুল হক - পরিচয়

প্রবন্ধ

১. বঙ্কিম চন্দ্র চট্টোপাধ্যয়- বাঙ্গালা ভাষা
২. রবীন্দ্রনাথ ঠাকুর- সভ্যতার সংকট
৩. হরপ্রসাদ শাস্ত্রী- তৈল
৪. প্রথম চৌধুরী- যৌবনে দাও রাজটিকা
৫. কাজী নজরুল ইসলাম- বর্তমান বিশ্বসাহিত্য
৬. মুহম্মদ আবদুল হাই- আমাদের বাংলা উচ্চারণ
৭. কবীর চৌধুরী- আমাদের আত্ন পরিচয়

ছোটগল্প ও অন্যান্য রচনা

১. রবীন্দ্রনাথ ঠাকুর- পোস্ট মাস্টার
২. রোকেয়া সাখাওয়াত হোসেন- অবরোধ বাসিনী
৩. বিভূতিভূষণ বন্দোপাধ্যায়- পুঁইমাচা
৪. সৈয়দ ওয়ালীউল্লাহ- নয়নচারা
৫. জাহানারা ইমাম- একাত্তরের দিনগুলি
৬. হাসান আজিজুল হক- ঘরগেরস্থি
৭. আখতারুজ্জামান ইলিয়াস- অপঘাত

নাটক

১. কবর - মুনির চৌধুরী

HUM 1171: Technical English	**Credit Hours: 2.00**

Course Content

General discussion: Introduction to various approaches of learning English.
Grammatical Problem: Construction of sentences, grammatical errors, sentence variety and style, conditionals, vocabulary and diction;

Reading Skill: Discussion readability, scan and skin reading, generating ideas through purposive reading, reading selective stories;
Approaches to Communication: Communication today, business communication, and different types of business communication.
Listening Skill: The phonetics and correct English pronunciation, Speaking Skill: Practicing dialogue, storytelling.
Writing Skill: Principles of effective writing, organization, planning and development of writing, composition (Paragraph, Comprehension), précis writing, amplification, General Strategies for the Writing process: Generating ideas, identifying audiences, and purposes, construction arguments, stating problems, drafting and finalizing, Report Writing: Defining a report, classification of reports, structure of a report and writing of report.

Recommended Books

1	Prose of Our Time	:	Ahsanul Haque, Serajul Islam Chowdhury & M.Shamsuddoha;NawrozeKitabistanBanglabazar, New Market.
2	A Guide to Correct speech	:	S.M. Amanullah
3	Business Correspondence and Report Writing	:	R.C. Sharma & Krishna Mohan; Tata McGraw- Hill Publishing Company Ltd.

HUM 1172: Technical English Sessional **Credit Hours: 1.00**

Course Content

Listening skills and note taking: Listening to recorded texts and class lectures and learning to take useful notes based on listening;
Developing speaking skill: Communicative expressions for personal identification, life at home, giving advice and opinion, instruction and directions, requests, complains, apologies, describing people and places, narrating events, Tutorial Discussion – On a given topic to test the proper use of phonetics, pronunciation, grammar, logic and confidence; Public Speaking – Demonstration by teacher for a short specific period, speaking by students (each student minimum twice) on different but easy given topic well in advance as per a schedule maximum for 3.00 to 4 minutes for each student; Extempore – Minimum two presentations by each student for a duration of maximum 3.00 to 4 minutes; Debriefing on public speaking and extempore presentation ; Presentation – On a given professional topic or on a given research paper using power point for 40 minutes followed by question and answer session, Group presentation on different given topics by the students using power point.

Recommended Books

1	Introduction to Linguistics	:	Prof Dr. Maniruzzaman
2	A Guide to Correct Speech	:	S M Amanullah
3	English Grammar in Use	:	Raymond & Murphy
4	From Paragraph to Essay	:	Maurice Imhoof and Herman Hudson
5	Headway Series	:	Advanced Level (2 parts with CDs): Oxford University Press Ltd.

HUM 1255: Bangladesh Studies (History of Independence) Credit Hours: 2.00

Course Content

Ancient period and Muslim period of Bengal, British period, Pakistan period: an overview (1952-1971), The problem of national integration under Ayub regime, Elite in crisis during Pakistan rule, nation-building in the new state, The ideals and philosophy of constitution-making of Bangladesh, Study on the coup and assassination of Bangobandhu Sheikh Mujib, Philosophy and fundamental changes of Zia regime, Constitutional amendments of Bangladesh, Corruption and good governance in Bangladesh, Issues of governance of Bangladesh, Bangladesh economy, Ideas on political and ethnic conflict in Bangladesh, Geographical setting of Bangladesh, environmental challenges of Bangladesh, Bangladesh foreign policy: realities and challenges, Foreign policy-decision-making process in Bangladesh.

Recommended Books

1	Bangladesh in International Politics	:	Muhammad ShamsulHuq (1995),The University Press Limited,Dhaka-1000
2	Constitution,ConstitutionalLawandPolitics:BangladeshPerspective	:	Md.Abdul Halim, CCB Foundation,Dhaka-1000
3	Bangladesh in the Twenty-First Century: Towards an Industrial Society	:	A M A Muhith (1999), The University Press Limited,Dhaka-1000
4	Bangladesh Foreign Policy: Realities, Priorities and Challenges	:	HarunurRashid (2012, 2nd Edition), Academic Press and Publishers Library,Dhaka-1209
5	The Changing Pattern of Bangladesh Foreign Policy: A Comparative Study of Mujib and Zia Regimes	:	ZaglulHaider (2008), The University Press Limited, Dhaka-1000
6	Bangladesh Studies and Culture	:	Sumon Das & M.N. Mohabbat,Human Publications
7	History of Emergence of Bangladesh	:	MuntasirMamun & MahbuburRahman,UGC

HUM 2127: Financial and Managerial Accounting Credit Hours: 3.00

Course Content

Financial Accounting: Objectives and importance of accounting; Accounting as an information system. Computerized system applications in accounting. Recording system, double-entry mechanism; account and their classification

Accounting equation: Accounting cycle: Journal, ledger, trial balance. Preparation of financial statements considering adjusting and closing entries; Accounting concepts (principles) and conventions

Financial statement analysis and interpretation: Ratio analysis. Cost and Management Accounting: Cost concepts and classification; Overhead cost: meaning and classification; Distribution of overhead cost: Overhead recover method/rate; Job order costing: preparation of job cost sheet and question price, Inventory valuation: absorption costing and marginal/variable costing technique

Cost-Volume-Profit analysis: meaning, break-even analysis, contribution margin analysis sensitivity analysis. Short-term investment decisions; relevant and differential cost analysis.

Long-term investment decisions: capital budgeting, various techniques of evaluation of investments.

Recommended Books

1	Managerial Accounting	:	Ray Garrison, Eric Noreen, and Peter Brewer; McGraw Hill
2	Accounting Principles		Jerry J. Weygandt Paul D. Kimmel Donald E. Kieso; Wiley

HUM 2177: Fundamentals of Economics **Credit Hours: 2.00**

Course Content

Microeconomics: Definition of economics; Fundamentals of economics; Economic System; Basic elements of supply and demand; Choice and utility; indifference curve technique; Analysis of cost; Theory of production; Analysis of Market; Factors pricing and distribution

Macroeconomics: the key concept of macroeconomics; saving, consumption, investment; National income analysis; Inflation, Unemployment; Banking; Fiscal and monetary policy

Development: Theories of developments; Economic problem of developing countries; Planning in Bangladesh

Recommended Books:

1	Economics	:	Paul A. Samuelson and Nordhaus
2	Principles of Economics	:	N. Gregory Mankiw
3	Modern Economic Theory	:	K.K. Dewett

HUM 3257: Society, Environment and Ethics **Credit Hours: 3.00**

Course Content

Society: Definition and types of society, Social change, Industrial revolution, Capitalism, Globalization, Demographic Transition, Migration, Media, Social Process, Social Problems, Theories of Development, and Urbanization.

Environment: Relationship between Environment and Technology, Importance of Protecting the Environment, Climate Change, Global Warming, Sustainable Development Goals Declared by UN, Sustaining Biodiversity, Resources and Human Society.

Ethics: Importance of Ethics, Functions of Norms and Values, Historical Background of Ethics, Human Rights, Social Justice, The Conflict Between Sales Orientation and Ethics.

Recommended Books

1	Sociology, London, The Polity Press, 2009	:	Giddens, Anthony
2	Environmental Science, Boston, Cengage Learning, 2016	:	Miller, G. Tyler and Spoolman, Scott E.
3	Sociological Theory, Mcgraw-Hill, 1992	:	Ritzer, George

Chapter 7
Elective Courses

7.1 Power

EEE 4*73:Renewable Energy	Credit Hours: 3.00

Course Content

Importance of renewable energy, sources. Statistics regarding solar radiation and wind speed. Insulation: geographical distribution, atmospheric factors, measurements. Solar cell: principle of operation, spectral response, factors affecting conversion efficiency, I-V characteristics, maximum power output. PV modules and arrays: stationary and tracking. PV systems: stand alone, battery storage, inverter interfaces with grid. Wind turbine generators: types, operational characteristics, cut-in and cut-out speed, control, grid interfacings, AC-DC-AC link.

Recommended Books

1	Renewable Energy	:	Bent Sorensen
2	Renewable Energy	:	Tomasa B. Johansson, et al.
3	Renewable Resources for Electric power: Prospects and Challenges	:	Raphael Edinger, Sanjay kaul.

EEE 4*71:Power System II	Credit Hours: 3.00

Course Content

Insulators for overhead lines: Types of insulators, their constructions and performance, potential distribution in a string of insulators, string efficiency, methods by equalizing potential distribution, special types of insulators, testing of insulators.

Mechanical characteristics of transmission line: Sag and Tension Calculations with equal and unequal heights of towers, effect of wind and ice loading on weight of conductor, effect of temperature changes, corona and corona power loss.

Transmission Line Parameters: Types of conductors-calculation of resistance for solid conductors-calculation of inductance for single phase and three phase, single and double circuits lines, concept of GMR and GMD, symmetrical and asymmetrical conductor configuration with and without transposition, numerical problems. calculation of capacitance for 2 wire and 3 wire systems, effect of ground on capacitance, capacitance calculations for symmetrical and asymmetrical single and three phase, single and double circuit lines, numerical problems.

Underground Cables : Types of cables, construction, types of insulating materials, calculations of insulation resistance and stress in insulation, numerical problems, capacitance of single and 3-core belted cables, numerical problems, grading of cables- capacitance- capacitance grading, numerical problems, description of inter-sheath grading, HV cables.

Power system stability: Swing equation: Derivation of swing equation, determination of transient stability by equal area criterion, application of equal area criterion, critical clearing

angle calculation, solution of swing equation, point by point method, methods to improve stability, application of auto reclosing and fast operating circuit breakers.

Recent trends in transmission system: Overview of flexible ac transmission system (FACTS), high voltage dc transmission system (HVDC) and SCADA.

Recommended Books

1	Elements of Power System Analysis	:	William D. Stevenson, Jr.
2	Electrical Power Systems	:	Ashfaq Husain
3	Electrical Power Systems		C L Wadhwa

EEE 4*75:Power Plant Engineering **Credit Hours: 3.00**

Course Content

Power plants: Schematic Arrangement and constituents of different power stations, General layout and principles of steam turbine power plant, efficiency of steam power station, gas turbine power plant, combined cycle power plant, hydro power plant, different types of water turbine, nuclear power plant, nuclear fuel and fission reaction, different types of nuclear reactors, nuclear hazards, major advantages and disadvantages of power stations, Power plant instrumentation.

Selection of location: Technical, economic and environmental factors.

Variable Load on Power Stations: plotting and analysis of load curve, chronological Load curve, Load duration curve, demand factor, diversity factor, load duration curve, energy load curve, load factor, plant capacity factor, utilization factor etc. and there impact over cost analysis. Load sharing: Base load and peak load plants.

Economics of power generation: Cost of electrical energy, Method of determining depreciation, power factor correction, causes and effect of low power factor, Power factor improvement equipment, most economical power factor

Load forecasting: factors affecting load forecasting, necessities and challenges of load forecasting selection of units and plant location**,** Generation scheduling: Deterministic and probabilistic.

Electricity tariff: desirable characteristics of tariff, Formulation and types.

Recommended Books

1	Power Plant Engineering	:	G R and G. R. Nagpal
2	Power Station Engineering & Economy	:	William A. Vopat
3	Electric Power Engineering Handbook		L.L. Grigsby
4	Power Plant Engineering		P. K Nag
5	Principles of Power System		V.K. Mehta Rohit Mehta

EEE 4*77:Power System Protection **Credit Hours: 3.00**

Course Content

Introduction to Switchgear: Purpose of power system protection, Introduction to Switchgear, circuit interruption and protection. Criteria for detecting faults and requirements of protective devices, Terminologies and general characteristics of relays and circuit breaker.

Fuse & Relay: Fuse and its types, Relays: over-current, differential, directional, distance. Electromechanical relay.

Circuit Breakers: control systems, Trip circuit, arc extinction methods, Types of circuit breaker, Different types of protective devices used in Switchgear.

Circuit Breaker Ratings: circuit breaker ratings, recovery voltage, TRV, Switching in a capacitive circuit, Current chapping. Air, Oil, air blast, SF6, vacuum and high voltage DC circuit breaker, Selection criteria, testing of circuit breakers.

Transformer Protection: Different types of faults in Transformer, different types of protection scheme in transformer, Buchholz Relay etc. Integrated HV transmission line protection, Combined Transformer and Bus bar protection.

Generator and Motor protection: Introduction, Different types of faults in Generator and motor, different types of protection scheme.

Bus and Transmission Line Protection: Bus bar arrangement, Pilot-wire and carrier current protection, different types of Bus and Transmission line protection scheme, over voltage protection, lightning and lightning arresters, Grounding

Static and Digital/Numerical Relay: Definition, features, Operation, application, Block diagram and types, Microcontroller and Microprocessor based protection.

Recommended Books

1 Switchgear protection and Power Systems : Sunil S. Rao
2 Power System Protection and Switchgear : Badri Ram
3 Fundamentals of power system protection : Y. G. Paithankar

EEE 4*78:Power System Protection Sessional **Credit Hours: 1.50**

Course Contents

This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in EEE 4*77. In the second part, students will design simple systems using the principles learned in EEE 4*77.

Recommended Books

1 Switchgear protection and Power Systems : Sunil S. Rao
2 Power System Protection and Switchgear : Badri Ram
3 Fundamentals of power system protection : Y. G. Paithankar

EEE 4*79:Power System Reliability **Credit Hours: 3.00**

Course Content

Review of probability concepts. Probability distribution: Binomial, Poisson, and Normal. Reliability concepts: Failure rate, outage, mean time to failure, series and parallel systems and redundancy. Markov process, Probabilistic generation and load models. Reliability indices: Loss of load probability and loss of energy y probability. Frequency and duration, Reliability evaluation techniques of single area system, Introduction to the evaluation of interconnected system, jointly owned unit.

Recommended Books

1 Reliability Evaluation of Power System : Billinton and Allan; Pitman Advanced Publishing Program.
2 Reliability Evaluation of Engineering System : R. Billinton and R. N. Allan; Pitman Advanced Publishing Program, New York

EEE 4*81:Power System Operation and Control **Credit Hours: 3.00**

Course Content

Overview: Vertically integrated vs. deregulated power system. Real-time operation: SCADA; EMS (Energy Management System); various data acquisition devices - RTU, IED, PMU, DFDR, WAMPAC (wide area monitoring, protection and control).

Application Functions: State estimation; short term load forecasting; unit commitment (UC); economic dispatch (ED); optimal power flow (OPF). Frequency control: generation and turbine governors, droop, frequency sensitivity of loads, ACE (area control error), AGC (Automatic Generation Control) and coordination with UC and ED; frequency collapse and emergency load shed.

Power system security: Static and dynamic; security constrained OPF.

Electricity Market Operation: GenCos, ISO, DisCos, bidding, spot market, social welfare, market clearing price (MCP), locational marginal price (LMP), bilateral contracts and forward market, hedging.

Demand Side Control: DMS (distribution management system), DSM (demand side management), and smart grid concept.

Recommended Books

Power System Optimization : D P Kothari and J S Dhillon
Modern Power System Analysis : I J Nagrath and D P Kothari
Element of Power System Analysis : J. J. Grainger and W. D. Stevenson,
The Algebra of Modern Variable : M. D. Springer

EEE 4*83:High Voltage Engineering **Credit Hours: 3.00**

Course Content

High voltage supplies: AC: Cascaded Transformers, Tesla coils. DC: Valve Rectifier circuits, Cascaded Rectifiers, Electrostatic generators, Graff generators.

Impulse Generators: Impulse voltage wave shapes, Mathematical analysis and design

consideration of impulse generators. Triggering of impulse generators. Measurement of high voltages: Sphere gap and uniform gap methods.

Corona: Power loss calculation, Breakdown of solid, liquid and gaseous dielectrics. Insulation testing, standard specifications; High voltage DC. Transmission, merits and demerits over AC transmission; Bridge arrangement. Mathematical analysis of the bridge circuit, Regulation, Reactive power, artificial commutation.

Protection against lighting and Insulation co-ordination: Lighting phenomena, Direct and indirect lighting, Transmission line design based on direct strokes, ground wire;

Protective devices: lightning arrestors and protector tubes; Insulation co-ordination and transformer
insulation protection; Selection of lighting arrester, BIL.

Recommended Books

1	High Voltage Engineering	:	Naidu; Tata McGraw-Hill
2	High Voltage Engineering	:	Wadhwa; New Age India
3	High Voltage Engineering		M. Khalifa; Dekker.

EEE 4*84:High Voltage Engineering Sessional **Credit Hours: 1.50**

Course Content

This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in EEE 4*83. In the second part, students will design simple systems using the principles learned in EEE 4*83.

Recommended Books

1	High Voltage Engineering	:	E. Kuffel
2	High Voltage Engineering	:	M S Naidu

EEE 4*85:Electrical Machines III **Credit Hours: 3.00**

Course Content

Basic principle of energy conversion:

Nonconventional energy conversion: solar-photovoltaic, solar-thermal, wind, geothermal, wave and tidal energy, MHD (Magneto Hydrodynamic) systems.

Motors and drives: series universal motor, permanent magnet DC motor, brushless DC motor (BLDC), stepper , reluctance motor, switched reluctance motor, hysteresis motor, repulsion motor, permanent magnet synchronous motor, linear induction motor, electro static motor.

Recommended Books

1	Alternating Current Machines	:	A.F. Puchntein T.C Lisoyd; John Wiley & Sons, Inc. New York.
2	Electric Machine and Transformers	:	Irving L. Kowow; Prentice Hall of India
3	Electrical Machinery Fundamental	:	Stephan J. Chapman; McGraw- Hill

7.2 Electronics

EEE 4*51:Processing and Fabrication Technology **Credit Hours: 3.00**

Course Content

Substrate materials: Crystal growth and wafer preparation, epitaxial growth technique, molecular beam epitaxy, chemical vapor phase epitaxy and chemical vapor deposition (CVD). Doping techniques: Diffusion and ion implantation.

Growth and deposition of dielectric layers: Thermal oxidation, CVD, plasma CVD, sputtering and silicon-nitride growth.

Etching: Wet chemical etching, silicon and GaAs etching, anisotropic etching, selective etching, dry physical etching, ion beam etching, sputtering etching and reactive ion etching. Cleaning: Surface cleaning, organic cleaning and RCA cleaning. Lithography: Photo-reactive materials, pattern generation, pattern transfer and metallization.

Discrete device fabrication: Diode, transistor, resistor and capacitor. Integrated circuit fabrication: Isolation - pn junction isolation, mesa isolation and oxide isolation. BJT based microcircuits, p-channel and n-channel MOSFETs, complimentary MOSFETs and silicon on insulator devices. Testing, bonding and packaging.

Recommended Books

1 Introduction to VLSI : D. Bricius; McGraw-Hill international.
2 An Introduction to VLSI Physical Design : C. K. Wong; McGraw-Hill Higher Education.
3 Basic VLSI Design : Douglas A. Pucknell; Prentice Hall of India

EEE 4*53:Analog Integrated Circuit **Credit Hours: 3.00**

Course Contents

Review of FET amplifiers: Passive and active loads and frequency limitation. Current mirror: Basic, cascade and active current mirror.

Differential Amplifier: Introduction, large and small signal analysis, common mode analysis and differential amplifier with active load.

Noise: Introduction to noise, types, representation in circuits, noise in single stage and differential amplifiers and bandwidth.

Band-gap References: Supply voltage independent biasing, temperature independent biasing, proportional to absolute temperature current generation and constant transconductance biasing. Switch capacitor circuits: Sampling switches, switched capacitor circuits including unity gain buffer, amplifier and integrator.

Phase Locked Loop (PLL): Introduction, basic PLL and charge pumped PLL.

Recommended Books

1 Analog Integrated Circuit Design : David Johns, Kenneth William Martin, and Tony.
2 Analysis And Design Of Analog Integrated Circuits : Paul R Gray, Meyer, Lewis, Hurst.

EEE 4*55:Compound Semiconductor and Hetero-junction Devices Credit Hours: 3.00

Course Contents

Compound Semiconductor: Zinc-blend crystal structures, growth techniques, alloys, band gap, density of carriers in intrinsic and doped compound semiconductors.

Hetero-Junctions: Band alignment, band offset, Anderson's rule, single and double sided hetero- junctions, quantum wells and quantization effects, latticemismatch and strain and common hetero-structure material systems.

Hetero-junction diode: Band banding, carrier transport and I-V characteristics. Hetero-junction field effect transistor: Structure and principle, band structure, carrier transport and I-V characteristics.

Hetero-structure Bipolar Transistor (HBT): Structure and operating principle, quasi-static analysis, extended Gummel-Poon model, Ebers-Moll model, secondary effects and band diagram of a graded alloy base HBT.

Recommended Books

1 Compound Semiconductors: Physics, Technology, and Device Concepts **:** Ferdinand Scholz
2 Novel Compound Semiconductor Nanowires: Materials, Devices, and Applications **:** Fumitaro Ishikawa, Irina Buyanova
3 Physics and Technology of Heterojunction Devices **:** D. Vernon Morgan, Robin H. Williams

EEE 4*57 :VLSI II Credit Hours: 3.00

Course Content

VLSI MOS system design: Layout extraction and verification, full and semi-full custom design styles and logical and physical positioning.

Design entry tools: Schematic capture and HDL. Logic and switch level simulation. Static timing. Concepts and tools of analysis, solution techniques for floor planning, placement, global routing and detailed routing.

Application specific integrated circuit design including FPGA.

Recommended Books

1 Introduction to VLSI **:**D. Bricius; McGraw-Hill international.
2 An Introduction to VLSI Physical Design **:**C. K. Wong; McGraw-Hill Higher Education.
3 Basic VLSI Design **:**Douglas A. Pucknell; Prentice Hall of India private Ltd.

EEE 4*58:VLSI II Sessional Credit Hours: 1.50

Course Content

VLSI MOS system design: Layout extraction and verification, full and semi-full custom design styles and logical and physical positioning.

Design entry tools: Schematic capture and HDL. Logic and switch level simulation. Static timing. Concepts and tools of analysis, solution techniques for floor planning, placement, global routing and detailed routing.

Application specific integrated circuit design including FPGA.

Recommended Books

1	Introduction to VLSI	:	D. Bricius; McGraw-Hill international.
2	An Introduction to VLSI Physical Design	:	C. K. Wong; McGraw-Hill Higher Education.
3	Basic VLSI Design	:	Douglas A. Pucknell; Prentice Hall of India private Ltd.

EEE 4*59: Optoelectronics **Credit Hours: 3.00**

Course Contents

Optical Properties in Semiconductor: Direct and indirect band-gap materials, radiative and non-radiative recombination, optical absorption, photo-generated excess carriers, minority carrier life time, luminescence and quantum efficiency in radiation.

Properties of Light: Particle and wave nature of light, polarization, interference, diffraction and blackbody radiation.

Light emitting diode (LED): Principles, materials for visible and infrared LED, internal and external efficiency, loss mechanism, structure and coupling to optical fibers.

Stimulated emission and light amplification: Spontaneous and stimulated emission, Einstein relations, population inversion, absorption of radiation, optical feedback and threshold conditions.

Semiconductor Lasers: Population inversion in degenerate semiconductors, laser cavity, operating wavelength, threshold current density, power output, hetero-junction lasers, optical and electrical confinement. Introduction to quantum well lasers.

Photo-detectors: Photoconductors, junction photodetectors, PIN detectors, avalanche photodiodes and phototransistors.

Solar cells: Solar energy and spectrum, silicon and Schottkey solar cells.

Modulation of light: Phase and amplitude modulation, electrooptic effect, acousto-optic effect and magentooptic devices. Introduction to integrated optics.

Recommended Books

1	Optoelectronics and Photonics: Principles and Practices	:	Safa Kasap
2	Optoelectronics	:	Borge Vinter, Emmanuel Rosencher

EEE 4*61:Semiconductor Devices Theory **Credit Hours: 3.00**

Course Content

Processing of devices: Bulk and epitaxial crystal growth,

Etching: Wet chemical etching, RIBE, plasma etching, ion beam milling.

Doping of Semiconductors: Epitaxial doping, doping by diffusion, ion implantation.

Lithography: Photo-resist Coating, mask generation and image transfer.

Hetero-Junction Devices: Band alignment, band offset, Anderson's rule, single and double sided hetero-junctions, quantum wells and quantization effects, lattice mismatch and strain and common hetero-structure material systems, Hetero-Junction diode, Band banding, carrier transport and I-V characteristics, hetero-junction field effect transistor, structure and principle, band structure, carrier transport and I-V characteristics: **Optoelectronics:** Direct and indirect band-gap materials, radiation and non-radiation recombination, optical absorption, reviews of properties of light: Particle and wave nature of light, polarization, interference, diffraction and blackbody radiation.

Light emitting diode (LED): Principles, materials for visible and infrared LED, LASER, Photo-detectors, solar energy converter.

Recommended Books

1 Principles of Electronic Materials and Devices : S. O. Kasap

7.3 Communication and Signal Processing

EEE 4*03:Telecommunication Engineering **Credit Hours: 3.00**

Course Content

Introduction: Principle, evolution, networks, exchange and international regulatory bodies. Telephone apparatus: Microphone, speakers, ringer, pulse and tone dialing mechanism, side-tone mechanism, local and central batteries and advanced features.

Switching system: Introduction to analog system, digital switching systems – space division switching, blocking probability and multistage switching, time division switching and two dimensional switching.

Traffic analysis: Traffic characterization, grades of service, network blocking probabilities, delay system and queuing.

Modern telephone services and network: Internet telephony, facsimile, integrated services digital network, asynchronous transfer mode and intelligent networks. Fiber to the home (FFTH), Fiber access networks: EPON, GEPON, WDM-PON and TDM-PON. Introduction to cellular telephony and satellite communication.

Recommended Books

1 Digital switching systems : Syed R. Ali; Mc Graw Hill international
2 Digital Telephony : John Bellamy; John Wiley & sons, Inc
3 Telecommunication Switching Systems and Networks : ThiagarajanViswanathan; Prentice Hall of India

EEE 4*31:Digital Signal Processing II **Credit Hours: 3.00**

Course Content

Spectral estimation of random processes: classical methods, minimum variance method, parametric methods: AR and ARMA spectral estimation, Levinson-Durbin algorithm, super resolution techniques: Pisarenko, and MUSIC.

Adaptive signal processing: Applications, e.g., equalization, interference suppression, acoustic echo cancellation. FIR and IIR adaptive filters. Recursive least squares algorithm, steepest descent and Newton algorithm, least mean-square (LMS) algorithm, convergence analysis. Variable step-size LMS algorithm.

Multirate DSP: Interpolation and decimation, single-stage and multistage implementation, design of anti-aliasing and anti-imaging filters. Polyphase representation of multirate systems. Multirate implementation of ideal LP filter, digital filter banks, narrowband filters. Perfect reconstruction filters banks. Short time Fourier transform, subband decomposition and wavelet transform, CWT, DWT, inter-scale relationship of DWT coefficients, multirate implementation. Applications of wavelet transform.

Recommended Books

1	Digital Signal Processing: Principles, Algorithms and Applications	:	John G. Proakis, Dimitris K Manolakis; Pearson Education
2	Digital Signal Processing	:	Emmanuel C. Ifeachor & Barrie w. Servis; Addision Wesley Publishing Company.
3	Signal and System (Continuous & Discrete)	:	Rodger E. Ziemer, W. H. Tranter & D. R. Fannin; Pearson Education

EEE 4*33:Microwave Engineering **Credit Hours: 3.00**

Course Content

Transmission lines: Voltage and current in ideal transmission lines, reflection, transmission, standing wave, impedance transformation, Smith chart, impedance matching and loss transmission lines.

Microwave Components: Cavities, Slow wave structures, Waveguide Tees, Directional Couplers, Circulators and Isolators, S-parameter.

Waveguides: General formulation, modes of propagation and losses in parallel plate, rectangular, coaxial and circular waveguides.

Microstrip Lines: Structures and characteristics.

Rectangular resonant cavities: Energy storage, losses and Q. Radiation: Small current element, radiation resistance, radiation pattern and properties, Hertzian and half wave dipoles.

Microwave tubes: Klystron amplifier, multicavity klystron amplifier, Reflex Klystron oscillator, magnetron, TWT amplifier, BWO.

Semiconductor microwave devices: Tunnel diodes, Gunn-Effect diodes, IMPATT diodes.

Antennas: Mono pole, horn, rhombic and parabolic reflector, array, and Yagi-Uda antenna.

Recommended Books

1	Microwave Engineering, Second Edition, John Wiley & Sons, 1998.	:	D. M. Pozar
2	Microwave Devices and Circuits	:	Samuel Y. Liao; Prentice Hall of India.
3	Foundations for Microwave Engineering	:	E. Colliong; McGraw-Hill International

EEE 4*34:Microwave Engineering Sessional **Credit Hours: 1.50**

Course Content

In this course students will perform experiments to verify practically the theories and concepts learned in EEE 4*33.

Recommended Books

1	Microwave Engineering, Second Edition, John Wiley & Sons, 1998.	:	D. M. Pozar
2	Microwave Devices and Circuits	:	Samuel Y. Liao; Prentice Hall of India.
3	Foundations for Microwave Engineering	:	E. Colliong; McGraw-Hill International

EEE 4*35:Optical Fiber Communication **Credit Hours: 3.00**

Course Content

Introduction: Light propagation through optical fiber: Ray optics theory and mode theory.

Optical fiber: Types and characteristics, transmission characteristics, fiber joints and fiber couplers.

Light sources: Light emitting diodes and laser diodes. Detectors: PIN photo-detector and avalanche photo-detectors.

Receiver analysis: Direct detection and coherent detection, noise and limitations.

Transmission limitations: Chromatic dispersion, nonlinear refraction, four wave mixing and laser phase noises.

Optical amplifier: Laser and fiber amplifiers, applications and limitations.

Multi-channel optical system: Frequency division multiplexing, wavelength division multiplexing and optical CDMA. Radio on fiber technology, Fiber optic access network.

Recommended Books

1	Optical Fiber Communications: Principles and Applications	:	T. L. Singal
2	Fiber Optic Data Communication	:	Casimer DeCusatis

EEE 4*37 : Digital Communication **Credit Hours: 3.00**

Course Content

Introduction: Communication channels, mathematical model and characteristics. Probability and Stochastic processes.

Source coding: Mathematical models of information, entropy, Huffman code and linear predictive coding.

Digital transmission system: Base band digital transmission, inter-symbol interference, bandwidth, power efficiency, modulation and coding trade-off. Digital band pass transmission.

Modulation: Binary and M-ary modulation schemes, coherent and non-coherent receiver structure.

Receiver for AWGN channels: Correlation demodulator, matched filter demodulator and maximum likelihood receiver.

Channel capacity and coding: Channel models and capacities and random selection of codes. Block **codes and conventional codes:** Linear block codes, convolution codes and coded modulation. Spread spectrum signals and system.

Recommended Books

1	Simon Haykin; McGraw Hill International	:	Digital Communications
2	G.J Proakis	:	Digital Communication

EEE 4*38: Digital Communication Sessional **Credit Hours: 1.50**

Course Content

In this course students will perform experiments to practically verify the theories learned in the theory course EEE 4*37

Recommended Books

1 Simon Haykin; McGraw Hill International : Digital Communications
2 G.J Proakis : Digital Communication

EEE 4*39:Mobile Cellular Communication **Credit Hours: 3.00**

Course Content

Introduction: Concept, evolution and fundamentals. Analog and digital cellular systems.

Cellular Radio System: Frequency reuse, co-channel interference, cell splitting and components.

Mobile radio propagation: Propagation characteristics, models for radio propagation, antenna at cell site and mobile antenna.

Frequency Management and Channel Assignment: Fundamentals, spectrum utilization, fundamentals of channel assignment, fixed channel assignment, non-fixed channel assignment, traffic and channel assignment.

Handoffs and Dropped Calls: Reasons and types, forced handoffs, mobile assisted handoffs and dropped call rate.

Diversity Techniques: Concept of diversity branch and signal paths, carrier to noise and carrier to interference ratio performance. Multi-carrier modulation, Orthogonal FDM (OFDM). Multiple Access Techniques: FDMA, TDMA, CDMA, MC-CDMA and receiver.

Digital cellular systems: Global system for mobile, time division multiple access and code division multiple access. 3G and 4G and 5G wireless system, future wireless communication system, Wi-Fi, Wi-max and other IEEE standards of wireless communication system.

Recommended Books

1 William C.Y Lee : Mobile Cellular Telecommunication (Analog Digital Systems)
2 Theodore. S.Rapport : Wireless Communications
3 Simon Haykin, Michael Moher : Modern Wireless Communications

EEE 4*41:Random Signals and Processes **Credit Hours: 3.00**

Course Content

Introduction to number systems and codes.

Probability and Random variables: Sample space, set theory, probability measure, conditional probability, total probability, Bayes theorem, independence and uncorrelated ness. Expectation, Variance, moments and characteristic functions. Commonly used distribution and density functions. Central limit theorem. Transformation of a random variables: one, two and N random variables. Joint distribution, density, moments and characteristic functions. Hypothesis Testing.

Random Processes: Correlation and covariance functions. Process measurements. Gaussian, and Poisson random processes. Markov Process. Noise models. Stationarity and Ergodicity. Spectral Estimation. Correlation and power spectrum. Cross spectral densities. Response of linear systems to random inputs. Statistical Estimation Techniques (ML, MMSE, MAP).

Recommended Books

1 Probability, Random Variables, and Stochastic Processes : Athanasios Papoulis

2 Fundamentals of Applied Probability and Random Processes : Oliver C. Ibe

EEE 4*43:Radar and Satellite Communication **Credit Hours: 3.00**

Course Content

The Basic Concepts of Satellite Communications: The Evolution of satellite communication. Advantages of satellite communication. The rudimentary principles of satellite communication. Satellite frequency bands, frequency re-use, transmission and multiplexing, Atmosphere and atmospheric layers, space. Satellite orbits, altitude, apogee and perigee, satellite axes (roll, pitch, yaw), azimuth, elevation angle, look angle, slant range sub-satellite point. l

Segments of a Satellite Mission: Earth segments- programme office, mission management and control center, processing and archiving facilities, user interface, system components ,location, Launch vehicle segment. Available launch vehicles, launch vehicle selection . launch vehicle mass and volume constrains. Space Transportation System(STS).

Station keeping Satellite power supply system: The basic ideas, general consideration of power generation, solar array, batteries, power failure, eclipse and its effects on communication satellite.

Satellite antenna: Types of antenna used on satellites. Basic relationships in satellite antenna. Satellite antenna patterns and coverage zones. Satellite antenna in practice. earth station antenna and their types.

Very small aperture terminal (VSAT) networks: VSAT technologies, VSAT system overview, network configurations, VSAT protocols, VSAT system design, VSAT antenna, VSAT regulation, advantages and applications of VSAT system.

Random Access Techniques in Satellite Communication: P-ALOHA, S-ALOHA, R-ALOHA, C-ALOHA.

Multiple Access Techniques in Satellite Communication FDMA: FDM-FM-FDMA, SCPC, FM-FDMA television, Companded FDM-FM-FDMA, TDMA: TDMA frame structure, TDMA burst structure, TDMA frame efficiency, TDMA super frame structure.

Mobile communication through satellite: MSAT network concept, statistics of mobile propagation, land mobile satellite propagation: channel models, mobile satellite services, mobile satellite system parameters, network availability, network capacity, system design objectives, CDMA MSAT networks.

Introduction: Rudimentary vision of Radar. Evolution of Radar Developments, The Radar Equation, Basic System Parameters, Radar Block Diagram and Operation, Radar Displays, Radar Frequency Bands, Radar Applications. Classifications of radars.

CW and FM Radar: The Doppler Effect, CW Radar, FM-CW Radar, Multiple Frequency CW Radar, Waveform Analysis, Design Considerations of FM-CW systems.

MTI and Pulse Doppler Radar: MTI Radar, Pulse Doppler Radar, Delay Line Canceler, Staggered Pulse Repetition Frequencies, Range-Gated Doppler Filters, Design Considerations of MTI Systems.

Tracking Radar: Tracking Radar, Sequential Scanning, Mono-pulse Tracking, error Analysis of Angle Measurement.

Satellite based Radar Technology: Concepts of radar imaging, scattering properties of imaging radars, Satellite tracking radars, techniques of Synthetic Aperture Radar (SAR) image generation.

Recommended Books

1 Tri T. Ha : Digital Satellite Communications
2 Timothy Pratt : Satellite Communications
3 G.B. Bleazard Introducing Satellite Communications, NCC Publications
4 B.R. Elbert Introduction to Satellite Communications, Artech Hou

EEE 4*44:Radar and Satellite Communication Sessional Credit Hours: 1.50

Course Content

In this course students will perform experiments to practically verify the theories learned in the theory course EEE 4*43

Recommended Books

1 Tri T. Ha : Digital Satellite Communications
2 Timothy Pratt : Satellite Communications

EEE 4*45 Communication Networks Credit Hours: 3.00

Course Content

Switching and multiplexing: ISO, TCP-IP and ATM reference models.

Different data communication services: Physical layer wired and wireless transmission media.

Cellular radio: Communication satellites;

Data Link Layer: Elementary protocols. Sliding window protocols, error detection and corrections of HDLC.DLLL of Internet. DLLL of ATM: Multiple Access protocols. IEEE.802 Protocols for LANs and MANs, Switches, Hubs and bridges. High speed LAN Network Layer: Routing, congestion control, internetworking.

Network layer in internet: IP protocol, IP addresses. ARP; NI in ATM transport layer, transmission control protocol, UDP, ATM adaptation layer, application layer, network security, email, domain name system. Simple network management protocol, HTTP and World Wide Web

Recommended Books

1 Data Communications and Networking : Behrouz A. Forouzan

EEE 4*46:Communication Networks Sessional **Credit Hours: 1.50**

Course Content

This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in EEE 4*45. In the second part, students will design simple systems using the principles learned in EEE 4*45

Recommended Books

1 Data Communications and Networking : Behrouz A. Forouzan

7.4 Interdisciplinary

EEE 4*21:Control System II **Credit Hours: 3.00**

Course Content

Modeling of physical Systems-Linearization and its consequences, Concepts of state and State-space. Derivation of state models from transfer functions and ordinary differential equations. Solution of state equations- Controllability and Observe ability. Classification of synthesis method of sensitivity and error analysis and stability. Design via state space, Performance measures like ISE, ITAE; Quadratic indices.

State equations of digital systems with sample and hold, state equation of digital systems, digital simulation and approximation. Solution of discrete state equations: by z-transform, state equation and transfer function, state diagrams, state plane analysis. Stability of digital control systems. Digital simulation and digital redesign. Time domain analysis. Frequency domain analysis. Optimal linear digital regulator design. Digital state observer. Microprocessor control. Introduction to neural network and fuzzy control, adaptive control, Hα Control, nonlinear control

Recommended Books

1 Linear Control System Analysis and Design : John J.D Azzo, Constantine H.Houpis

EEE 4*22: Control System II Sessional **Credit Hours: 1.50**

Course Content

Hardware experiments & simulations based on EEE 4*21.

Recommended Books

1 Linear Control System Analysis and Design : John J.D Azzo, Constantine H.Houpis

EEE 4*99:Antenna Array Signal Processing **Credit Hours: 3.00**

Course Content

Fundamentals of Antennas: Analysis of H.F transmission lines (lossless and lossy). Different types of Modern Transmission lines, smith chart and its applications, Impedance matching

techniques and applications. Guided E.M. waves, Parallel plane and Rectangular waveguides, cavity resonator. Antennas and radiation, small current element antenna, Long straight antenna, Radiation patterns and gain. Frequency Independent and Log periodic antennas.

Antenna Arrays: Two-Element Array, N-element Linear Arrays: Broad-side, End-fire, Phased, Binomial, DolphTchebyschef and Super-Directive Arrays, Determination of Array Factor and Patterns, Planar and Circular Arrays.

Aperture, Reflector and Lens Antennas: Huygens's Principle, Rectangular and Circular Apertures, Microstrip Antennas. Babinet's Principle, Sectoral, Pyramidal and Conical Horns, Parabolic and cassegrain Reflector Antennas, Lens Antennas.

Antenna Measurement: Antenna ranges, Radiation Pattern, Radiation power Density, Power Intensity, Beamwidth, Gain and Directivity, Effective length, Effective aperture, Equivalent Circuit Model, and corresponding parameters, Polarization.

Radio wave propagation: Ground wave propagation, Ionospheric propagation, Propagation losses.

Recommended Books

1	Fields and Waves in Communication Engineering.	Simon Ramo, John R. Whinnery, Theodore Van Duzer;
2	Microwave Engineering, Wiley Text Books; 2nd edition.	David M. Pozer
3	Microwave Devices and Circuits	S.Y. Liao

EEE 4*91:Microprocessor System design **Credit Hours: 3.00**

Course Content

Fundamental Concepts: Microprocessor: A programmable device; microcomputer components and support ICs, building blocks of MPU based systems, microprocessor buses, programming principles using MASM, microprocessor instructions.

Simple-As-Possible (SAP) Computer: SAP-1, selected concepts from SAP-2 and SAP-3 (jump, call, return, stack, push and pop). Evolution of microprocessors, microprocessor architecture and operation.

Introduction to Intel 8086 Microprocessor: Features, architecture.

Minimum mode operation of 8086 microprocessors: system timing diagrams of read and write cycles, memory banks, design of decoders for RAM, ROM and PORT.

Introduction to Intel 8086 Assembly Language Programming: Basic instructions, logic, shift and rotate instructions, addressing modes, stack management and procedures, advanced arithmetic instructions for multiplication and division, instructions for BCD and double precision numbers, introduction to 8086 programming with C language.

I/O Hardware Interfacing with Intel 8086 Microprocessor: Introduction to embedded system, categories and applications, Major components in a typical embedded system, operating requirement, and modes of operation, hardware/software co-designs, and hardware-software trade-offs. Input devices, output devices, memory mapping, bus structures, programmable peripheral interface, programmable interrupt controller, programmable timer, serial

communication interface, keyboard and display interface (LED, 7 segments, dot matrix and LCD), Direct memory access (DMA).

Operating System: Design and organization of embedded and real-time operating systems, scheduling, power management, communication, debugging.

Advanced Microprocessors and Microcontrollers: History of the evolution of MPU/MCU, multitasking systems, PVAM operation of Intel high performance architecture, overview of 80286 architecture, instruction and programming; overview of 80386 architecture, instruction and programming; CISC and RISC microcontrollers, instruction and programming.

Recommended Books

1	Microprocessors and Interfacing	:	Douglas V. Hall
2	Microprocessor and Microprocessor-based System Design	:	M. Rafiquzzaman
3	Microprocessor Hardware Interfacing and Application	:	Barry B. Brey
4	Digital Logic and Computer Design	:	Morris Manno
5	Computer System and Architecture	:	M. Morris Manno
6	Microprocessor Architecture, Programming and Applications	:	R. Gaonkar

EEE 4*92:Microprocessor System design Sessional **Credit Hours: 1.50**

Course Content

In this course students will perform experiments to practically verify the theories learned in the theory course EEE 4*91. Instructors are encouraged to include Microcontroller based projects as design work.

Recommended Books

1	Microprocessors and Interfacing	:	Douglas V. Hall
2	Microprocessor and Microprocessor-based System Design	:	M. Rafiquzzaman
3	Microprocessor Hardware Interfacing and Application	:	Barry B. Brey
4	Digital Logic and Computer Design	:	Morris Manno
5	Computer System and Architecture	:	M. Morris Manno

The End

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