Bangamata Sheikh Fojilatunnesa Mujib Science & Technology University

Department of Electrical and Electronic Engineering
Faculty of Engineering

Course Curriculum
B.Sc. in EEE
Session: 2022–2023 and 2023-2024

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ACADEMIC FACULTIES AND DEPARTMENTS

Faculties

1. **Faculty of Engineering**
   (i) Department of Electrical and Electronic Engineering (EEE)
   (ii) Department of Computer Science and Engineering (CSE)

2. Faculty of Science

(i) Department of Fisheries
(ii) Department of Mathematics
(iii) Department of Geology

3. **Faculty of Business**
   (i) Department of Management
4. **Faculty of Social Science**
   (i) Department of Social Work

List of Faculty Members of EEE department

1. **Dr. Md. Rasidul Islam**

   Chairman & Assistant Professor

   B.Sc. and M.Sc. in EEE (KUET),

   Ph.D. (IS-CAS, China)

   Field of Specialization: Semiconductor material and devices.

2. **Md. Shizer Rahman**

   Lecturer

   B.Sc. and M.Sc. in EEE (RUET),

   Field of Specialization: Semiconductor material, Biomedical.

3. **Md. Mahfuzul Haque**

   Lecturer

   B.Sc. in EEE (SUST), M.Sc. in EEE (BUET),

   Field of Specialization: Semiconductor material and Nano-photonics.

RULES AND REGULATIONS FOR UNDERGRADUATE PROGRAMS FOR THE AWARD OF BACHELOR OF SCIENCE IN ENGINEERING DEGREE

1. Duration of Course and Course Structure

1.1 The Bachelor of Science in Engineering abbreviated as B.Sc. Engg. Programs shall extend over a period of four academic years, each of a normal duration of one calendar year, divided into two semesters called 1st semester and 2nd semester. The four academic years of study have been designated as 1st year class, 2nd year class, 3rd year class and 4th year class in succeeding higher levels of study. Students shall be admitted into the 1st year class.

1.2 The Academic Council will form an Admission Committee in each academic session for admission into 1st year class. Students will be admitted to the department as per university rules.

1.3 The curriculum of the B.Sc. Engg. Degree in the different departments shall be proposed by the Committee of Courses and approved by the Syndicate on the recommendation of the Academic Council.

1.4 The Committee of Courses shall review the curricula at least once in every Academic Year and recommend changes and revision, if any, to the Faculty, and then the Faculty will recommend to the Academic Council.

1.5 Teaching of the courses is reckoned in terms of credits and the credits allotted to various courses will be determined by the Committee of Courses under the following guidelines;

Nature of Course	**Contact Hour/ Credit (in a semester)**
Theoretical Lecture	: 1 hour/week
Laboratory/Design	: 2 - 3 hours/week
Project/Thesis	: 2 - 3 hours/week
Field Work/Industrial Attachment	: 2 -3 weeks of field work

1.6 **Contact Hours/week:** The total contact hours for the regular students including Lecture, Tutorial, Project/Thesis, Field Work/Industrial Attachment and Laboratory shall be at least 24 periods per week, each period being 60 minutes in duration.

1.7 **Course Coordinator:** One of the teachers nominated by the Academic Committee shall act as Course coordinator for each academic year. With the approval of Academic Committee, Course coordinator will prepare the class routine, showing details of the lectures, course plan etc. at the beginning of each semester.

2. Course Designation and Numbering System

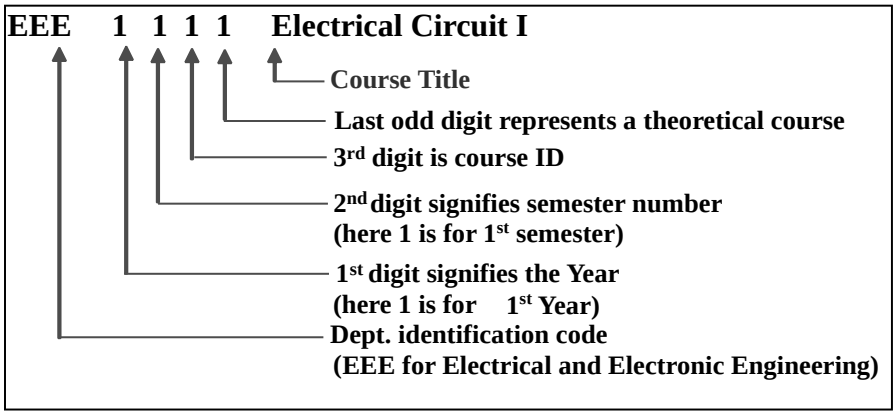
Each course is designated by a two to four letter word usually identifying the course offering department followed by a four-digit number with the following criteria without any space between letters and numerical.

(a) The first digit will correspond to the Year in which the course is normally taken by the students.
(b) The second digit will correspond the semester (1 for 1st and 2 for 2nd) in which the course is normally taken by the students.

(c) The third digit will be reserved for departmental use for such things as to identify different areas within a department.

(d) The last digit will be odd for theoretical, even/zero for laboratory courses, Project/Thesis, Field Work/Industrial Attachment, Board Viva voce.

The course designation system is illustrated by the following example.



3. Duration of Examination

Duration of Theoretical examination of different courses at the end of semester shall be as follows:

Courses greater than or equal to 2 credits but less than or equal to 3 credits	3 Hours	5 set questions to be answered out of 7 set questions. Each set carries 14 marks.

4. Academic Calendar

4.1 The academic year shall be divided into two semesters each having duration of not less than 11 teaching weeks.

4.2 There shall be final examinations at the end of each semester conducted by the respective Examination Committee of the Departments.

4.3 **An academic schedule for the academic year shall be announced for general notification before the start of the academic year, on the approval of the Academic Committee. The schedule may be prepared according to the following guidelines:**

Semester-1st (22 weeks)	**Number of Weeks**
Teaching	14 (70 working days)
Preparatory Leave	2
Examination Period	3
Result Publication	2
Inter Semester Recess	1
Total Weeks	**22**
Semester-2nd (22 weeks)	
Teaching	14 (70 working days)
Preparatory Leave	2
Examination Period	3
Result Publication	2
Inter Semester Recess	1
Total Weeks	**22**
Vacation (Summer, Ramadan, and Others)	8
Total:	**52**

5. Attendance

In order to be eligible to appear, as a regular candidate, at the semester final examinations, a student shall be required to have attended at least 70% of the total number of periods of lectures/tutorials/laboratory classes offered during the semester in every course. A student whose attendance falls short of 70% but not below 60% in any course may be allowed to appear at the final examinations as non-collegiate student and he/she shall not be eligible for the award of any scholarship or stipend. A student, appearing the examination under the benefit of this provision shall have to pay in addition to the fees, the requisite fee prescribed by the syndicate for the purpose. Student having less than 60% attendance in any course will not be allowed to appear in the final examinations of the semester. An attendance report of the students will be prepared by the concerned course teacher and posted for information of the students. The basis of awarding marks for class participation and attendance is shown in the following Table.

Table-1: Distribution of Marks in Attendance

Attendance	Marks (%)	Remarks
90% and above	100	**Regular**
85% to less than 90%	90	
80% to less than 85%	80	
75% to less than 80%	70	
70% to less than 75%	60	
65% to less than 70%	50	**Non-collegiate**
60% to less than 65%	40	
less than 60%	0	

6. Class Test

6.1 For theoretical courses of less than or equal to 2 credits there shall be at least 2 class tests and at least 3 class tests for greater than 2 credits in a semester. Previous class test marks will remain valid for the reported/ course improvement student if he/she is unable to appear at class test.

6.2 The course teacher must submit the detailed class test marks and their average in percentage to the Chairman of the Examination Committee in a sealed envelope. A copy will be also sent to the controller of the examination. If a course is conducted by more than one course teacher, class test marks will be processed by the examination committee.

7. The Grading System

The letter grade system shall be used to assess the performance of the students as shown in the following Table:

Table-2: Grading System

Marks	Letter Grade (LG)	Grade Point (GP)
80% or above	A+	4.0
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.5
65 to less than 70%	B+	3.25
60% to less than 65%	B	3.0
55% to less than 60%	B-	2.75
50 to less than 55%	C+	2.5
45% to less than 50%	C	2.25
40 to less than 45%	D	2.0
less than 40%	F	0.0

Absence of a candidate in an examination of a course in which he/she ought to have been present will be considered as if the candidate obtained zero marks ('F' grade) in that course.

A **Grade Point Average (GPA)** shall be calculated for each semester as follows:

$$GPA = \frac{\sum_{i=1}^{n} C_i G_i}{\sum_{i=1}^{n} C_i} \qquad \text{(i)}$$

where, n is the number of courses offered during the semester, C_i is the number of credits allotted to a particular course and G_i is the grade point earned for that course.

A **Yearly Grade Point Average (YGPA**) shall be calculated for each academic year as follows:

$$YGPA = \frac{\sum_{j=1}^{2} C_j G_j}{\sum_{j=1}^{2} C_j} \qquad \text{(ii)}$$

Where 2 is the number of semesters, C_j is the number of credits allotted to the j^{th} semester and G_j is the GPA earned for that semester.

The **Cumulative Grade Point Average (CGPA)** gives the cumulative performance of the students from the first year up to the end of the year to which it refers, and will be calculated as follows:

$$CGPA = \frac{\sum_{k=1}^{m} C_k G_k}{\sum_{k=1}^{m} C_k} \qquad \text{(iii)}$$

where, m is the total number of years being considered, C_k is the total number of credits registered during the kth year and G_k is the YGPA earned in that particular year.

A Cumulative Grade Point Average (CGPA) shall be calculated at the end of each academic year and to be communicated to the students along with the YGPAs. The individual grades of courses obtained by them for the semesters of the academic year will, however, be communicated at the end of individual semester by the Chairman of the Examination Committee.

CGPA will be recorded up to 2nd digit following the rounding rule. If the third digit is less than 5, it will be immediately truncated, but if the third digit is greater than or equal to 5, the second digit will be added by 1 and only the first two digits after decimal will be kept for record. The YGPA will be rounded to the third place of decimal while CGPA is rounded to the second place for reporting. **For instance, YGPA=2.2125 shall be rounded as YGPA=2.213 while CGPA=2.215 shall be rounded as CGPA=2.22.**

Illustration: Suppose a student obtained following grade in 1st year 1st semester:

B.Sc. Engg. 1st Year 1st Semester	**Credit**	**Letter Grade**	**Grade Point**
EEE 1111	3	B+	3.25
EEE 1112	1.5	A+	4
HUM 1111	3	C	2.25
HUM 1112	0.75	A-	3.5
MATH 1111	3	A+	4
PHY 1111	3	F	0
PHY 1112	0.75	A-	3.5
CSE 1111	3	A-	3.5
CSE 1112	1.5	A	3.75

Therefore, GPA in the 1st semester is = $\frac{3(3.25)+1.5(4)+3(2.25)+0.75(3.5)+3(4)+3(0)+0.75(3.5)+3(3.5)+1.5(3.75)}{3+1.5+3+0.75+3+3+0.75+3+1.5} = 2.9038 \approx 2.904$

And let's assume that his/her GPA in 1st year 2nd Semester is = 3.25

Therefore, YGPA of **1st Year** examination is = $\frac{19.5(2.904)+19(3.25)}{19.5+19}$

$= 3.0747 \approx 3.075$

Similarly assume that, the student's YGPA for the other 3 Years are the followings.

Year	**Credit**	**YGPA**
2nd	41.25	3.470
3rd	43	3.35
4th	37.25	3.334

Then his/her **CGPA** of four academic years is

$= \frac{38.5(3.075)+41.25(3.470)+43(3.35)+37.25(3.334)}{160} = 3.311 \approx 3.31$

8. Evaluation Strategy

8.1 Distribution of marks for Theoretical Part:

a.	Class Attendance	10%
b.	Continuous Assessment (Class test, Performance, Assignment, Presentation, etc.)	20%
c.	Semester Final Exam	70%
	Total	**100%**

8.2 Distribution of marks for Laboratory Part:

a.	Lab Attendance	10%
b.	Continuous Assessment (Lab Report, Class Performance, Quiz etc.)	40%
c.	Lab Final Test and Lab Viva Voce	50%
	Total	**100%**

8.3 Project Work/Thesis/Field Work/Professional Training/Seminar:

a.	Internal Evaluation	50%
b.	Presentation and Oral Examination	50%
	Total	**100%**

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

B.Sc. Engg. in Electrical and Electronic Engineering

The Electrical and Electronic Engineering (EEE) program combines a rigorous education in electrical and electronic engineering with added emphasis on the design of electrical, electronic and communication system. It is rich in challenges and applications, since electrical and electronic engineering are everywhere: in science and engineering, design and manufacturing, commerce and public services, defense, transportation, arts and the media, communication sector, entertainment, and the home. With the background knowledge of electrical and electronic engineering, our graduates will be able to perform professional work in the field of EEE. The Department of EEE at Bangamata Sheikh Fojilatunnesa Mujib Science & Technology University (BSFMSTU) offers four-year Bachelor of Science in Engineering (B.Sc. Engg.) degree program in EEE with an ambition of producing competent personnel who can take up this ever-growing challenge and excel at the top most level.

B.Sc. Engg. program in Electrical and Electronic Engineering (EEE)

- Degree Award: B.Sc. Engg.
- Total Credit: 160
- Duration: 4 Academic Years with 8 Semesters

Vision

The vision of the Electrical and Electronic Engineering (EEE) department is to provide education in EEE to meet national needs, to conduct interdisciplinary research that creates materials for tomorrow's innovative technologies, to be at the forefront of the international community in developing strategies to overcome evolving challenges and to be the leading EEE department worldwide. This Department aims at developing the ability of students to live flexibly and aggressively in our rapidly changing society as well as fosters future scientists and engineers with their research and extension to advance our modern way of life.

Mission

The mission of the Department of Electrical and Electronic Engineering at BSFMSTU is to,

- Create a stimulating and nurturing educational environment broadly preparing students at all levels for successful careers;
- Advance a fundamental understanding of materials properties, processing, and applications by performing leading-edge, world-class research;
- Train the most highly valued EEE students in the nation; Lead the advanced materials effort at BSFMSTU;
- Professionalism and leadership in contemporary, interdisciplinary engineering practice based on materials, while accounting for the impact of their profession on an evolving, global society;
- Promote a greater understanding of the role of EEE society, and actively participate in national and international professional societies.

The Program Educational Objectives (PEOs)

The Program Educational Objectives (PEOs) are intended to prepare graduates professionally eligible after completion of their graduation. The purpose of PEOs is to prepare graduates to possess the ability to:
PEO-1: Apply their Engineering knowledge and up-to-date skills to assume positions of technical leadership to perform professional work in the field of Electrical and Electronic Engineering either individually or with interdisciplinary teams.

PEO-2: Pursue their career through post-graduate education or professional activity and engage them in independent and life-long learning in the broadest context of technological change.
PEO-3: Develop Electrical and Electronic Engineering solutions, maintaining high ethical standard and considering design criteria, realistic constraints, economic, environmental and social impact of the solutions.
PEO-4: Work either individually or through interdisciplinary teams and communicate effectively using graphic, verbal and written techniques to explain and defend their solutions to technical and non-technical audiences.

Program Learning Outcomes (PLOs)

The following program learning outcomes describes the skills imparted by our engineering graduates are given below:

- **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using principles of mathematics, natural sciences, and engineering sciences.
- **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 the public health and safety, and the cultural, societal, and environmental considerations.
- **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- **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.
- **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 the professional engineering practice.
- **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- **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 and leader in a team, to manage projects and in multidisciplinary environments.

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

CURRICULUM

Distribution of Courses

The total credits have been set to **160 in eight semesters** for the program of B.Sc. Engg. in Electrical and Electronic Engineering in order to achieve Program Educational Objectives as well as to ensure the Program Learning Outcomes. The following credit distribution has been designed from the above perspective and based on these credit distributions; different courses are offered in different semester as given below.

Summary of the Subject-wise Distributions

Course Type	Credits
Mathematics and Basic Sciences	**18.75**
(a) Mathematics	9
(b) Statistics	3
(c) Physics	3.75
(d) Chemistry	3
Humanities	**12.75**
(a) Accounting & Economics for Engineers	3
(b) English	3.75
(c) Bangladesh Studies & Professional Ethics	3
(d) Industrial Management	3
Basic and Major Engineering	**121.5**
(a) Theoretical	87
(b) Sessional	34.5
Industrial Attachment	**0.75**
Project/Thesis	**4.5**
Seminar	**0.75**
Board viva-voce	**1**
Total	**160**

Summary of Undergraduate Course Plan

Year/ Semester	Theory		Sessional		Project/Thesis/ Viva/Seminar/Field work	Total Credits
	No. of Courses	Credits	No. of Courses	Credits		
1st/ 1st	5	15	4	4.5	0	**19.5**
1st / 2nd	5	15	3	4.5	0	**19.5**
2nd/ 1st	5	15	4	5.25	0	**20.25**
2nd/ 2nd	5	15	4	5.25	0	**20.25**
3rd/ 1st	5	15	4	4.5	0	**19.5**
3rd/ 2nd	5	15	5	5.25	0.75	**21**
4th/ 1st	5	15	4	3	1.5+0.75	**20.25**
4th/ 2nd	4	12	3	3.75	3+1	**19.75**
				Total		**160**

SEMESTER-WISE DISTRIBUTION OF COURSES

1st Year 1st Semester

Course Code	Course Title	Credit	Hours/ Week	
			Theory	Sessional
EEE 1111	Electrical Circuit I	3	3	0
EEE 1112	Electrical Circuit I Sessional	1.5	0	3
HUM 1111	Technical and Communicative English	3	3	0
HUM 1112	Technical and Communicative English Sessional	0.75	0	1.5
MATH 1111	Differential and Integral Calculus	3	3	0
PHY 1111	Physics	3	3	0
PHY 1112	Physics Sessional	0.75	0	1.5
CSE 1111	Computer Programming	3	3	0
CSE 1112	Computer Programming Sessional	1.5	0	3
	Total	**19.5**	**15**	**9**

1st Year 2nd Semester

Course Code	Course Title	Credit	Hours/ Week	
			Theory	Sessional
EEE 1211	Electrical Circuit II	3	3	0
EEE 1212	Electrical Circuit II Sessional	1.5	0	3
EEE 1221	Electronic Device and Circuit I	3	3	0
EEE 1222	Electronic Device and Circuit I Sessional	1.5	0	3
HUM 1211	Bangladesh Studies and Professional Ethics	3	3	0
MATH 1211	Linear Algebra, Coordinate Geometry and Vector Analysis	3	3	0
CHEM 1211	Chemistry	3	3	0
CE 1232	Engineering Drawing	1.5	0	3
	Total	**19.5**	**15**	**9**

2nd Year 1st Semester

Course Code	Course Title	Credit	Hours/ Week	
			Theory	Sessional
EEE 2111	Electrical Machine I	3	3	0
EEE 2112	Electrical Machine I Sessional	1.5	0	3
EEE 2121	Electronic Device and Circuit II	3	3	0
EEE 2122	Electronic Device and Circuit II Sessional	1.5	0	3
ME 2111	Basic Mechanical Engineering	3	3	0
ME 2112	Basic Mechanical Engineering Sessional	0.75	0	1.5
MATH 2111	Differential Equation, Laplace Transform and Fourier Analysis	3	3	0
HUM 2111	Accounting and Economics for Engineers	3	3	0
EEE 2100	Circuit Simulation Sessional	1.5	0	3
	Total	**20.25**	**15**	**10.5**

2nd Year 2nd Semester

Course Code	Course Title	Credit	Hours/ Week	
			Theory	Sessional
EEE 2211	Electrical Machine II	3	3	0
EEE 2212	Electrical Machine II Sessional	1.5	0	3
EEE 2231	Digital Electronics	3	3	0
EEE 2232	Digital Electronics Sessional	1.5	0	3
EEE 2241	Computational Methods for Engineers	3	3	0
EEE 2242	Computational Methods for Engineers Sessional	0.75	0	1.5
IPE 2211	Industrial Management	3	3	0
STAT 2211	Statistics for Engineers	3	3	0
EEE 2200	Electrical and Electronic Shop Practice	1.5	0	3
	Total	**20.25**	**15**	**10.5**

3rd Year 1st Semester

Course Code	Course Title	Credit	Hours/ Week	
			Theory	Sessional
EEE 3111	Measurement & Instrumentation	3	3	0
EEE 3112	Measurement & Instrumentation Sessional	1.5	0	3
EEE 3121	Engineering Materials	3	3	0
EEE 3131	Microprocessor and Microcontroller	3	3	0
EEE 3132	Microprocessor and Microcontroller Sessional	1.5	0	3
EEE 3141	Power Electronics	3	3	0
EEE 3142	Power Electronics Sessional	0.75	0	1.5
EEE 3151	Signals and Linear Systems	3	3	0
EEE 3100	Electrical Machine Design	0.75	0	1.5
	Total	**19.5**	**15**	**9**

3rd Year 2nd Semester

Course Code	Course Title	Credit	Hours/ Week	
			Theory	Sessional
EEE 3211	Communication Engineering I	3	3	0
EEE 3212	Communication Engineering I Sessional	1.5	0	3
EEE 3221	Power System I	3	3	0
EEE 3222	Power System I Sessional	0.75	0	1.5
EEE 3231	Power Plant Engineering and Environmental Issues	3	3	0
EEE 3241	Control Systems	3	3	0
EEE 3242	Control Systems Sessional	1.5	0	3
EEE 3251	Engineering Electromagnetics	3	3	0
EEE 3200	Engineering Project Design	1.5	0	3
EEE 3240	Technical Seminar	0.75	0	1.5
	Total	**21**	**15**	**12**

4th Year 1st Semester

Course Code	Course Title	Credit	Hours/ Week	
			Theory	Sessional
EEE 4111	Communication Engineering II	3	3	0
EEE 4112	Communication Engineering II Sessional	0.75	0	3
EEE 4121	Power System II	3	3	0
EEE 4122	Power System II Sessional	0.75	0	3
EEE 4131	Digital Signal Processing	3	3	0
EEE 4132	Digital Signal Processing Sessional	0.75	0	1.5
EEE 4141	Solid State Devices	3	3	0
EEE 41XX	Elective I	3	3	0
EEE 41XX	Sessional based on Elective I	0.75	0	1.5
EEE 4180	Thesis/ Project (Part I)	1.5	0	3
EEE 4190	Industrial Attachment	0.75	1-2 Weeks	
	Total	**20.25**	**15**	**12**

4th Year 2nd Semester

Course Code	Course Title	Credit	Hours/ Week	
			Theory	Sessional
EEE 42XX	Elective II	3	3	0
EEE 42XX	Elective II Sessional	0.75	0	1.5
EEE 4221	Power System Protection and Switchgear	3	3	0
EEE 4222	Power System Protection and Switchgear Sessional	1.5	0	3
EEE 4231	VLSI Circuits and Design	3	3	0
EEE 4232	VLSI Circuits and Design Sessional	1.5	0	3
EEE 42XX	Elective III	3	3	0
EEE 4280	Thesis/ Project (Part II)	3	0	6
EEE 4290	Board Viva-voce	1	0	0
EEE 4200	Industrial Tour	0	0	0
	Total	**19.75**	**12**	**13.5**

Table-I: List of Elective I Courses

Group	Course Code	Course Title	Credit	Hours/ Week	
				Theory	Sessional
Power	EEE 4141	Renewable Energy	3	3	0
	EEE 4142	Renewable Energy Sessional	0.75	0	1.5
	EEE 4151	High Voltage Engineering	3	3	0
	EEE 4152	High Voltage Engineering Sessional	0.75	0	1.5
Electronics	EEE 4161	Semiconductor Fabrication Technology	3	3	0
	EEE 4162	Semiconductor Fabrication Technology Sessional	0.75	0	1.5
Communication	EEE 4171	Computer Networks	3	3	0

& Signal Processing	EEE 4172	Computer Networks Sessional	0.75	0	1.5
	EEE 4181	Biomedical Engineering	3	3	0
	EEE 4182	Biomedical Engineering Sessional	0.75	0	1.5
	EEE 4191	Embedded Systems	3	3	0
	EEE 4192	Embedded Systems Sessional	0.75	0	1.5

Table-II: List of Elective II Courses

Group	Course Code	Course Title	Credit	Hours/ Week	
				Theory	Sessional
Power	EEE 4201	High Voltage DC and Flexible AC Transmission	3	3	0
	EEE 4202	High Voltage DC and Flexible AC Transmission Sessional	0.75	0	1.5
	EEE 4203	Special Machines and AC drives	3	3	0
	EEE 4204	Special Machines and AC drives Sessional	0.75	0	1.5
	EEE 4205	Nuclear Power Engineering	3	3	0
	EEE 4206	Nuclear Power Engineering Sessional	0.75	0	1.5
Electronics	EEE 4207	Optoelectronics	3	3	0
	EEE 4208	Optoelectronics Sessional	0.75	0	1.5
	EEE 4209	Analog Integrated Circuits	3	3	0
	EEE 4210	Analog Integrated Circuits Sessional	0.75	0	1.5
Communication & Signal Processing	EEE 4213	Microwave Engineering	3	3	0
	EEE 4214	Microwave Engineering Sessional	0.75	0	1.5
	EEE 4215	Telecommunications Engineering	3	3	0
	EEE 4216	Telecommunications Engineering Sessional	0.75	0	1.5
	EEE 4219	Wireless Communication	3	3	0
	EEE 4219	Wireless Communication Sessional	0.75	0	1.5
	EEE 4223	Digital Image Processing	3	3	0
	EEE 4223	Digital Image Processing Sessional	0.75	0	1.5

Table-III: List of Elective III Courses

Group	Course Code	Course Title	Credit	Hours/ Week	
				Theory	Sessional
Power	EEE 4225	Power System Operation and Control	3	3	0
	EEE 4227	Smart Grid	3	3	0
Electronics	EEE 4229	Semiconductor Device Theory	3	3	0
	EEE 4233	Introduction to Nanotechnology and Nanoelectronics	3	3	0

Communication & Signal Processing	EEE 4235	Optical Communications	3	3	0
	EEE 4237	Telecommunication Engineering	3	3	0
	EEE 4239	Radar and Satellite Communications	3	3	0
	EEE 4243	Wireless and Mobile Networks	3	3	0
	EEE 4245	Fuzzy Neuro Systems and Artificial Intelligence	3	3	0
	EEE 4247	Introduction to Medical Imaging	3	3	0

DETAILS OF THE OFFERED COURSES

1st Year 1stSemester

EEE 1111: Electrical Circuit I

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment and Presentation: 10%, Exam: 70%]

Motivation : To introduce students with the fundamental Electrical Circuits.

Objectives : Upon completion of the course students will acquire knowledge on electrostatics and electric current, transient current, chemical effects of current. They will also learn about magnetic field and its interaction, electromagnetic induction, alternating current and thermoelectricity. They are expected to have the ability to analyze electrical networks.

I L O (Intended Learning Outcomes) : Successful completion of this course should enable students to-

i. Get familiarized with electrical quantities, variables, laws and techniques to handle circuits.
ii. Calculate the response of various input sources in different electrical circuits
iii. Apply network theorem in solving electrical circuit related problems
iv. Analyze the AC quantities and single-phase AC circuits
v. Get familiarized with Magnetic quantities

Course Contents

Circuit Variables and Elements: Charge and current, voltage, power and energy, independent and dependent sources, resistance, inductance and capacitance.

Introduction to measuring instruments: Ammeter, voltmeter, galvanometer and wattmeter.

Basic Laws: Ohm's law, Kirchhoff's current and voltage laws. Voltage divider and current divider rules, Delta-Wye equivalent circuits. Solution of simple circuits with both dependent and independent sources, Series-parallel resistance 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: Linearity property, Superposition theorem, Thevenin's theorem, Norton's theorem and, Millman's theorem, Maximum power transfer theorem and Reciprocity theorem.

Energy Storage Elements: Properties of Inductances and capacitances, Series-parallel combinations of inductances and capacitances

Alternating current circuits: Instantaneous current, voltage, effective current and voltage, phasor and phasor relationships for circuit elements. Impedance, admittance, reactance, susceptance of RL, RC, and RLC branches.

Power relations in AC circuits: Real, reactive and apparent power, power factor, power factor improvement.

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.

Magnetic Quantities: 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. Comparison between electrical and magnetic quantities, Hysteresis and hysteresis loss, Magnetic materials, Analysis of series, parallel and series-parallel magnetic circuits.

Books Recommended:

1. R. Resnick and D. Halliday : Physics, Part-II
2. B. Grob : Basic Electronics
3. J. A. Edminister : Electric Circuits
4. A .R. Rafiqullah , A. K Roy & M.S Huq : Concepts of Electricity and Magnetism
5. C. K. Alexander and Sadiku : Fundamentals of Electric Circuits
6. Robert L. Boylestad : Introductory Circuit Analysis
7. B. L. Theraza : Electrical Technology

EEE 1112: Electrical Circuit I Sessional

Credits: 1.5, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Continuous Assessment: 40%, Exam: 50%]

Sessional based on theory course EEE 1111.

HUM 1111: Technical and Communicative English

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment and Presentation: 10%, Exam: 70%]

Motivation: To be able to communicate through one of the most dominating languages of the world, which has a great impact on every field of work.

Course Objective: The course aims to give students a formal and methodical exposure to Academic and Technical writing and professional communication skills. It intends to teach students the tools for writing technical error free English. It also intends to grow effective and fast reading skill among the students. Students will also be taught to speak English with correct pronunciation and phonetics.

I L O (Intended Learning Outcomes):

Successful completion of this course should enable students to-

i. Write technical articles and journals

ii. Speak fluently in English with the correct accent

iii. Read newspaper, technical papers, text books etc. and interpret correctly and swiftly.

iv. Comprehend English conversation.

Course Contents

General discussion: Introduction, various approaches to learning English.

Grammatical Problems: 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 of selected stories.

Writing Skill: Principles of effective writing; Organization, planning and development of writing; Composition, precis writing, amplification.

General strategies for the writing process: Generating ideas, identifying audiences and purposes, construction arguments, stating problems, drafting and finalizing.

Approaches to Communication: Communication today, business communication, different types of business communication.

Listening Skill: The phonemic systems and correct English pronunciation.

Speaking Skill: Practicing dialogue; Story telling; Effective oral presentation.

Report Writing: Defining a report, classification of reports, structure of a report, and writing of reports.

Recommended Books:

1. A. J. Thomson & A. V. Martinet : A Practical English Grammar, Oxford University Press
2. John M. Lannon : Technical Writing, Scott Foresman& Co.
3. A. Ashley : Oxford Handbook of Commercial Correspondence, Oxford University Press
4. John Swales : Writing Scientific English, Cengage Learning Australia
5. Robert J. Dixson : Complete Course in English, Prentice Hall

HUM 1112: Technical and Communicative English Sessional

Credits: 0.75, Contact Hours/ Week: 1.5

Marks: 100 [Attendance: 10%, Continuous Assessment: 40%, Exam: 50%]

Sessional based on theory course HUM 1111.

MATH 1111: Differential and Integral Calculus

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment and Presentation: 10%, Exam: 70%]

Motivation: Familiarize students with introductory calculus and coordinate geometry.

Course Objective: The main objective of this course is to provide necessary background of differential and integral calculus. Different mathematical problems in this course will help building a comprehensive skill for analyzing and solving real life engineering problems.

Course Contents

Functions: Domain, Range, Inverse function and graphs of functions, Composition of function,

Limits, Continuity, Indeterminate form.

Ordinary Differentiation: Differentiability, Differentiation, Successive differentiation and Leibnitz theorem.

Expansions of functions: Rolle's theorem, Mean value theorem, Taylor's and Maclaurin's formulae. Maximum and minimum of functions of one variable.

Partial Differentiation: Euler's theorem, Tangents and normal. Asymptotes.

Indefinite Integrals: Method of substitution, Integration by parts, Special trigonometric functions and rational fractions.

Definite Integrals: Fundamental theorem, General properties, Evaluations of definite integrals and reduction formulas.

Multiple Integrals: Determination of lengths, Areas and Volumes.

Recommended Books:

1. B. C. Das and B.N.Mukherjee : Differential Calculus,U. N. Dhur& Sons
2. B. C. Das and B.N.Mukherjee : Integral Calculus, U. N. Dhur& Sons
3. F. Ayres and Elliot Mendelson : Calculas (Schaum's Outline Series), McGraw-Hill
4. Joseph Edwards : Differential Calculas,Kessinger Publishing

PHY 1111: Physics

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment and Presentation: 10%, Exam: 70%]

Motivation: To know about the basic knowledge of electricity, magnetism and mechanics.

Course Objective: The main objective of this course is to provide necessary concepts about the applications of electricity, magnetism and mechanics in engineering. Both theoretical and practical knowledge will help building a comprehensive skill for analyzing and solving real life engineering problems.

Course Contents

Electricity and Magnetism: Electrostatic: Electric dipole; electric field due to a dipole; dipole on external electric field; Gauss's Law and its application.

Capacitors: Parallel plate capacitors with dielectric; dielectrics and Gauss's Law; susceptibility, permeability, and dielectric constant; energy stored in an electric field.

Electric Current: Electron theory of conductivity; conductor, semiconductors and insulators; superconductors, current and current density.

Electromagnetic Induction: Faraday's experiment; Faraday's law; Ampere's law, motional e.m.f.; self and mutual inductance galvanometers-moving coil, ballistic and deadbeat types.

Thermoelectricity: Thermal e.m.f; Seebeck, Peltier and Thomson Effects; laws of addition of thermal e.m.f., thermoelectric power.

Waves and oscillations: Differential equation of simple harmonic oscillator, total energy and average energy, combination of simple harmonic oscillations, spring mass system, torsional pendulum; two body oscillation, reduced mass, damped oscillation, forced oscillation, resonance, progressive wave, power and intensity of wave, stationary wave, 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, diffraction at double slit and N-slits, diffraction grating; polarization: Production and analysis of polarized light, Brewster's law, Nicol prism, optical activity, Polarimeters.

Recommended Books:

1. Leigh Page and Norman Ilsley Adams: Principles of Electricity, D Van Nosrand Co.
2. David Halliday, Robert Resnick and Kenneth S. Krane: Physics (Part-I & II), Wiley
3. Arthur Frederic Kip: Fundamentals of Electricity and Magnetism, McGraw-Hill Inc.
4. M. S. Huq: Concepts of Electricity and Magnetism, Students' Publications
5. F. W. Sears& G.L. Salinger: Thermodynamics, Kinetic Theory and Statistical Thermodynamics
6. F. W. Sears: Thermodynamics.

PHY 1112: Physics Sessional

Credits: 0.75, Contact Hours/ Week: 1.5

Marks: 100 [Attendance: 10%, Continuous Assessment: 40%, Exam: 50%]

Sessional based on theory course PHY 1111.

CSE 1111: Computer Programming

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment and Presentation: 10%, Exam: 70%]

Motivation: To accrue adequate fundamental knowledge required to build a sound base for studying computer science and programming.

Course Objective: In order to study some engineering course, a student must have some clear concept about the fundamental terms and terminologies of that subject. The objective of this course is to be able the student to understand the fundamental terminologies of computer science and programming. They will be trained to construct a workstation computer from scratch. They will be demonstrated the operation of computers and its elements.

Course Contents

Introduction to computers: Review of number systems and codes, hardware components, software and applications: Types of software and concept of operating systems, high level language, assembly language and machine language; problem solving technique, algorithm development and construction of flow chart; information technology fundamentals, internet, extranet and intranet.

Programming in C: Concepts and notations, variables, constants, data types, operators and operations, expressions and statements, control structures, input; functions and program structures: Function basics, parameter passing conventions, recursion; header files; arrays, string and pointers; user defined data type: structures, unions, enumeration; input and 47 output: standard input and output, formatted 48 input and output, file access.

Recommended Books:

1. Peter Norton : Introduction to Computer, McGraw-hill Publishers
2. J. Stanley Warford : Computer Systems, Jones & Bartlett Publishers
3. P. Norton : Inside the PC, Sam Publishers
4. L. Rosch : Hardware Bible, Braddy Publishing, Indianapolis
5. Subramanian : Introduction to Computers, Mcgraw-hill Inc.

CSE 1112: Computer Programming Sessional

Credits: 1.5, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Continuous Assessment: 40%, Exam: 50%]

Sessional based on theory course CSE 1111.

1st Year 2nd Semester

EEE 1211: Electrical Circuit II

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment & Presentation: 10%, Exam: 70%]

Motivation : To introduce the various phenomena associated with alternating current circuit and polyphase system.

Objectives : This course intends to give idea about single phase and three phase alternating current circuits, phasors, vector diagrams of electric circuits, coupled magnetic circuits, resonance phenomena and filters.

I L O (Intended Learning Outcomes) : Successful completion of this course should enable students to-

i. Analyze sinusoidal quantities with phasor and exponential representation.

ii. Calculate different form of power from AC circuits

iii. Apply circuit solution techniques and network theorem to AC circuits

iv. Solve the magnetically Coupled circuits and resonant circuits and two port networks.

v. Differentiate and analyze different 3-φ system

vi. Design and examine passive filters.

vii. Analyze the magnetic circuits.

Course Contents

Resonance in AC circuits: Series and parallel resonance, half-power bandwidth, quality factor.

Transients: Transient analysis in electrical (ac & dc) circuits. First order circuit: Source free RC circuit, Source free RL circuit, Responses of RL and RC circuits both natural and step responses. Second order circuit: Source free series RLC circuit, Source free parallel RLC circuit, Step response of series RLC circuit, Step response of parallel RLC circuit.

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.

Magnetic Coupled Circuits: Mutual Inductance, Energy in a Coupled Circuit, Linear Transformers, Ideal Transformers, Ideal Autotransformers.

Two-port analysis: Impedance parameters, Voltage gains, Current gains, Cascaded systems, admittance parameters, Hybrid parameters. Terminated two port networks; iterative impedance, image impedance, characteristic impedance, symmetrical two port networks.

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. Charles K. Alexander and Mathew N. O. Sadiku : Fundamentals of Electric Circuits
2. Russell M Kerchner and George F Corcoran : Alternating-Current Circuits
3. Robert L. Boylestad : Introductory Circuit Analysis
4. Wallace L Cassell : Linear Electric Circuits
5. R. C. Dorf and J. A. Svoboda : Introduction to Electric Circuits

EEE 1212: Electrical Circuit II Sessional

Credits: 1.5, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Continuous Assessment: 40%, Exam: 50%]

Sessional based on theory course EEE 1211.

EEE 1221: Electronic Device and Circuit I

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment and Presentation: 10%, Exam: 70%]

Motivation : To provide a vivid understanding of electronic circuits and components.

Objectives : This course introduces the characteristics and applications of semiconductor devices and circuits. Emphasis is on analysis, selection, biasing, and applications.

Course Contents

Introduction to Semiconductors: Energy band in solids (Metal, semiconductor and insulators), Charge carriers in intrinsic semiconductors, Fermi level in intrinsic semiconductors, Extrinsic semiconductors, Dopant atoms and energy levels, Charge neutrality, Fermi level in extrinsic semiconductors, Carrier-drift, Mobility, Diffusion, Carrier generation and recombination.

P-N junction and Diode circuits: 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. Half wave and full wave rectifiers, rectifiers with filter capacitor, characteristics of a Zener diode, Zener shunt regulator, clipping and clamping circuits. Characteristics and typical applications of Zener diodes, varactor diodes, and point contact diodes, tunnel diodes.

Bipolar Junction Transistors (BJT): The Transistor Action: basic principle of operation, simplified transistor current relations; modes of operation: BJT as a Switch, Amplification with BJT, Input and output characteristics of CB, CE, and CC transistor configurations. Operating point, Load line analysis, Bias Stability, Stability factor; Different types of transistor biasing, Design of transistor biasing circuits, Bias compensation, Thermal runaway, Thermal stability.

BJT Amplifiers: Concept of amplification, amplifier notation, current gain, voltage gain, power gain, amplifier input and output impedance, Base-biased Amplifier, Emitter-biased Amplifier, Small-signal

operation, Analyzing an Amplifier: DC and AC Equivalent circuit; amplifier gains, Loading effect, coupling methods,

Small-Signal Analysis of BJT: Small-Signal Low-Frequency Amplifiers: Transistor hybrid low-frequency model in CE configuration, Analysis of CE, CB and CC amplifiers using h-parameters, CE amplifier with emitter resistor, Emitter and Darlington Emitter Followers, Cascaded CE and CC Amplifiers, Analysis of multistage amplifier using hybrid model.

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. 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.

Small-Signal Analysis of FET: FET current sources/sinks, small signal analysis of active loads, design applications: differential and multistage amplifiers: FET differential amplifier, differential amplifier with active load, small signal analysis and frequency response of differential amplifiers.

Books Recommended:

1. Donald A. Neamen : Semiconductor Physics and Devices.
2. Robert Boylsted& Louis : Electronics Devices and Circuits
3. J. J. Millman& C. C Halkias : Electronics Devices and Circuits
4. Albert P. Malvino& David J. Bates : Electronic Principles
5. V. K. Mehta : Principles of electronics
6. B. G. Streetman : Solid State Electronic Devices
7. John Allison : Electronic Engineering Semiconductors and Devices
8. S. L. Gupta & V. Kumar : Handbook of Electronics

EEE 1222: Electronic Device and Circuit I Sessional

Credits: 1.50, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Continuous Assessment: 40%, Exam: 50%]

Sessional based on EEE 1221.

HUM 1211: Bangladesh Studies and Professional Ethics

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment and Presentation: 10%, Exam: 70%]

Motivation: To understand the culture, history and geography of Bangladesh and to introduce students about professional ethics and the laws concerned with business and labor

Course Objective: This course will give students a sound knowledge about the culture and civilization of our nation, socio-economical history and urbanization process of our country, development of Bengali language and literature, and the brief history from British colonial rule to the War of Independence and the Emergence of Bangladesh. This course also will familiarize students with the legal issues concerning business entities and labors. The second part of this course will teach the moral and ethical codes to be followed by an individual, especially by an engineer

Course Contents

Geographic and Demographic Features: Origin of the name of Bangladesh, Geographical location and area, river, weather, culture, Flora and Fauna. Ethnic and cultural diversity, society, religions and believes, arts, literature and culture of Bangladesh

The Liberation War of Bangladesh and its Background: Participation of Indian subcontinent, Two nation theory**,** Language Movement 1952, 1954 Election, Education movement 1962, Six-Point Movement, 1966, Mass Upsurge 1968-69, General Elections 1970, Non-cooperation Movement, 1971, Bangabandhu's Historic Speech of 7th March and declaration of independence of Bangladesh. Formation and Functions of Mujibnagar government, Role of Major Powers and of the UN, Surrender of Pakistani Army, Bangabandhu's return to liberated Bangladesh. Withdrawal of Indian armed forces from Bangladesh.

Political Parties of Bangladesh: Historical development; Leadership; Social Bases; Structure; Ideology and Programs; Factionalism; Politics of Alliances; Inter and Intra-Party Relations; Electoral Behaviour; Parties in Government and Opposition.

Forms of Government and its Organ: Types of government, government from liberation war to recent time. Legislature: Representation, Law-making, Financial and Oversight functions; Rules of Procedure, Gender Issues, Caucuses, Parliament Secretariat. Executive: Chief and Real executive e.g., President and Prime Minister, Powers and Functions; Cabinet, Council of Ministers, Rules of Business, Bureaucracy, Secretariat, Law enforcing agencies; Administrative setup- National and Local Government structures, Decentralization Programs and Local Level Planning.

Economy of Bangladesh: Economy with particular emphasis on developments including Poverty Alleviation, GNP, NNP, GDP, SDG, etc. after the emergence of the country.

Environment, Nature and Natural resources: Bangladesh's environment and nature and challenges and prospects with particular emphasis on conservation, preservation and sustainability. Natural resources of Bangladesh with focus on their sustainable harnessing and management.

The Constitution of the People's Republic of Bangladesh: Preamble, Features, Directive Principles of State Policy, Constitutional Amendments.

Trade, Globalization and Bangladesh: Economic and Political Dimensions; Roles of the WTO, World Bank, IMF, ADB, IDB and other development partners and Multi-National Corporations (MNCs).

Law: Principle of law of contract, agency, partnership, sale of goods negotiable instruments, insurance.

Company Law: The companies act with special reference to the amendments and ordinances applicable to Bangladesh. Law regarding formation, Incorporation, Management and winding up of companies.

Labor Law: The scope and sources of labor law. Law in relation to wages, hours, health, safety and other condition to work. The legislation effecting employment in factories. The trade union legislation arbitration, the policy of the state in relation to labor. Elementary principle of labor law. Cyber law, Industrial law etc.

History and Development of Engineering Ethics: Study of Ethics in Engineering. Applied Ethics in engineering. Human qualities of an engineer. Obligation of an engineer to the clients and to other engineers. Measures to be taken in order to improve the quality of engineering profession.

Ethical Expectations: Employers and Employees inter-professional relationship, maintaining a commitment of Ethical standards. Desired characteristics of a professional code. Institutionalization of Ethical conduct cyber law moral thoughts.

Recommended Books:

1. A History of Bangladesh- William Van Schendel, Cambridge University Press 2009
2. History of Bangladesh (1704-1971), Vol-1, Sirajul Islam (Edited), Asiatic Society of Bangladesh.
3. Social History of the Muslims of Bengal (English & Bangla Version)-Abdul Karim

4. Bangladesh National Culture and Heritage- A F Salahuddin Ahmed, Bazlul Mobin Chowdhury (Edited), An Introductory Reader, Independent University Bangladesh.
5. Social & Cultural History of Bengal, Vol-2 (English & Bangla Version)- M.A. Rahim
6. History of Ancient Bengal (In Bangla)- Ramesh Chandra Majumdar.
7. Talukdar Muniruzzaman –The Politics of development; The case of Pakistan
8. Harun-or-Rashid, The Foreshadowing of Bangladesh; Bengal Muslim League and Muslim Politic, 1906-1947, The University Press Ltd. Dhaka-2012
9. A Hand Book of Commercial Law, A. K. Sen
10. The Law of Contract, A. B.Siddique
11. Labour and Industrial Law, A. A. Khan
12. Professional Ethics and Civics Morals, Emile Durkheim

MATH 1211: Linear Algebra, Coordinate Geometry and Vector Analysis

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment and Presentation: 10%, Exam: 70%]

Motivation: To introduce students with linear Algebra, matrix and vector analysis and their uses in engineering.

Course Objective: The main objective of this course is to introduce the fundamentals of Linear Algebra to solve some mathematical equations. The course also introduces the study of vectors and Euclidean geometry, lines and planes in three-dimensional space.

Course Contents

Linear Algebra: Vector Space, Subspace, Sum and Direct Sum, Hilbert Space, Normed Linear Space, Branch Space, Basis and Dimension.

Linear Transformation: Range, Kernel, Nullity, Singular and Non-Singular Transformation.

Linear Operations: Matrix Representation of a Linear Operator. Change of Basis, Similarity and Linear Mapping.

Matrix: Definition of Matrices, Equality of two Matrices, Addition, Subtraction and Multiplication of Matrices, Equivalence of Matrices, Positive and Negative Matrices, Adjoint of Matrices, Transpose and Inverse of Matrices, Rank and Normal form of Matrices, System of Linear Equations, Solution of Homogeneous and Non-Homogeneous Systems, Determination of Eigen Values and Eigen Vectors, Solutions of Matrix Differential Equations

Co-ordinate Geometry: Co-ordinate Geometry of Two Dimensions: Change of Axes, Transformation of Co-Ordinates, Simplification of Equations of Curves.

Co-ordinate Geometry of Three Dimensions: System of Co-Ordinates, Distance between two Points, Section Formula, Direction Cosines and Projection, Planes and Straight Lines.

Vector Analysis: Vectors, Differentiation and Integration, Line, Surface and Volume Integrals, Gradient of a Function, Divergence and Curl of Vector and their Applications, Physical Significance of Gradient, Divergence and Curl, Vector Identities, Integral Forms of Gradient, Divergence and Curl, Green's Theorem, Stock's Theorem, Gauss's, Divergence Theorem.

Recommended Books:

1. Murray R.Spiegel : Schaum's Outline of Theory and Problems of Vector Analysis, S. Chand

2. V.O'Neil : Advanced Engineering Mathematics, Global Engineering

3.	Howard Anton and Chris Rorres	:	Elementary Linear Algebra: Applications Version, John Wiley
4.	Frank Ayres, Jr	:	Schaum's Outline of Theory and Problems of Matrices, McGraw-Hill
5.	A.R Vasishtha	:	Matrices

CHEM 1211: Chemistry

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment and Presentation: 10%, Exam: 70%]

Motivation: To know basics of physical and inorganic chemistry.

Course Objective: As per standards, the engineering graduates need to study some basic science courses like physics, chemistry, and mathematics in their undergraduate courses. The aim of this course is to review the basic knowledge of chemistry that they have learned in high school level as well as prepare them for a higher level of study. The physical and inorganic chemistry knowledge expected to help the EEE graduates in understanding the environmental impacts created by their designed systems and the way to resolve the negative issues.

Course Contents

Atomic Structure and Periodic Table: Modern concept of atomic structure and Periodic Table; related principles and Laws. Constitution and Periodic properties of elements (ionization potential, electronegativity, electron affinity, atomic and ionic radii).

Electronic Theory of Valency and Chemical Bonding: Different types of bonds (ionic, covalent, co-ordinate, hydrogen and metallic) Classification of solids on the basis of bonding and their properties. Atomic orbitals and their hybridization; valency bond and Molecular orbital theories.

Chemistry of Elements: Transition Elements, s and p block elements, Lanthanides and Actinides: Definitions, electronic configurations, preparations (nuclear transformations), general properties and uses.

Electrochemistry: Conductors, Electrolytes and Electrolysis; Faradays Laws of Electrolysis and their significance. Ohm's law and electrolytic conductance; Theories for electrolytic conductance (Arrhenius & Debye-Hükel). Ionic mobility, Kohlrausch's law, Transference Number and its determination; Activities, activity coefficient and Debye-Hükel limiting law. Electrochemical cells (Electrolytic and Galvanic/Voltaic): Electrode reaction and potentials. Reference electrodes; Reversible and concentration cells, Storage Batteries (or accumulators).

Chemical Equilibrium and Kinetics: Equilibrium and Equilibrium constants, Kc, Kp, Kx. Rate of reaction and rate constants; Le Chatelier principle and its application. Order and molecularity of a reaction; integrated rate expressions & half-lives of zeroth, first and second order reactions. Determination of order & temperature dependence of a reaction; energy of activation and Arrhenius equation. Transition-state theory of reaction rates. Characteristics of catalysis, promoters and inhibitors.

Spectroscopy:

Chromatographic Separation:

Surface Chemistry and Colloids: Adsorption and sorption; Characteristics of physical and chemical adsorptions. Fruendlich, Langmuir and Gibb's Adsorption isotherms; The BET equation. Crystalloids,

Colloids and their classification, preparation, properties (kinetic, colligative, optical & electrical) and importance. Original pf charge and stability of colloids (sols), Gold number; colloidal electrolytes. Elementary idea about emulsions and gels.

Recommended Books:

1. R. D. Madan : Modern Inorganic Chemistry, S. Chand Publishers
2. M. M. Haque and M. A. Nawab : Principles of Physical Chemistry, Nawab Publications
3. Esmarch S. Gilreath : Fundamental Concepts in Inorganic Chemistry, McGraw-Hill
4. G. M. Barrow : Physical Chemistry, McGraw-Hill
5. W. J. Moore : Physical Chemistry, Orient Blackswan Pvt. Ltd.

CE 1232: Engineering Drawing

Credits: 1.5, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Continuous Assessment: 40%, Exam: 50%]

Introduction- lettering, numbering and heading; instrument and their use; sectional views and isometric views of solid geometrical figures. Plan, elevation and section of multistoried building; building services drawings; detailed drawing of lattice towers.

2nd Year 1st Semester

EEE 2111: Electrical Machine I

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment and Presentation: 10%, Exam: 70%]

Motivation : To develop a sound background on DC machines and transformer.

Objectives : This course intends to provide necessary conception to work with DC machines, and transformer. Both DC generator and motors will be discussed in detail with regard to their construction, classification, connections, input/output, losses and efficiency.

I L O (Intended Learning Outcomes) : Successful completion of this course should enable students to-

i. Analyze the construction and operation of different DC Generator, motors and transformer.
ii. Analyze the areas of applications for different types of machines studied
iii. Realize the impact of efficiency and regulation of the machines
iv. Solve problems associated with the use of DC machines
v. Solve problems associated with the design of DC machines.

Course Contents

D.C. Generator: Principles, Construction, Classification, Armature windings, Voltage build up, Armature reactions and Commutation, Performance and testing, Compounding of DC generator, Generator characteristics, Voltage regulation, Losses and efficiency, Parallel operation.

D.C. Motor: Operation, Types, Back e.m.f, Torque equations, Motor characteristics, Speed-Torque Characteristics, Speed regulation, Losses and efficiency, Methods of speed control, Methods of braking, Starters, Amplidyne and Metadyne.

Single Phase Transformer: Principles, Types, Equivalent circuits, Performance and testing, Regulation, Losses and efficiency, Parallel operation, Auto-transformer, Instrument transformers.

Poly Phase Transformer: Poly phase transformer construction, Poly phase transformer connections, Harmonics in polyphase transformer, transformer cooling.

Recommended Books:

1.	Stephen J. Chapman	:	Electric Machinery and Power System Fundamentals
2.	A Fitzgerald	:	Electric Machinery
3.	B.L. Thereja, A.K. Thereja	:	A Textbook of Electrical Technology, Volume II
4.	J. Rosenblatt & M. H. Friedman	:	Direct and Alternating Current Machinery

EEE 2112 Electrical Machine I Sessional

Credits: 1.5, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Continuous Assessment: 40%, Exam: 50%]

Sessional based on theory course EEE 2111.

EEE 2121: Electronic Device and Circuit II

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment & Presentation: 10%, Exam: 70%]

Motivation : To provide a deeper understanding of advanced electronic circuits and components.

Objectives : This course introduces the characteristics and applications of small signal analysis of BJT and FET, Op-Amp circuit, feedback and oscillator. Emphasis is on analysis, selection, design and troubleshooting.

I L O (Intended Learning Outcomes) : Successful completion of this course should enable students to-

i. Analyze the characteristics of feedback and oscillator circuits

ii. Solve different problems associated with integrated circuits

iii. Realize the operation, applications and design of operational amplifier circuits

Course Contents

Operational Amplifiers: Ideal operational amplifier and OP-AMP circuits; Differential vs. common mode operations; applications of OP-AMP: inverting amplifier, non-inverting amplifier, summing amplifier, differential amplifier, logarithmic amplifier, operational transconductance amplifiers, exponential amplifier, differentiator, integrator, voltage to current converter, voltage follower; Non-ideality of op-amp; Frequency response, bandwidth and other practical limitation of op-amps, compensation techniques. Active filter-types and design, realization of low-pass and high pass first order and second order Butterworth filter using Op-Amps, bandpass and band reject filters, all pass filters; Voltage comparators, Schmitt trigger circuits.

Feedback and Stability: Basic feedback concept, positive and negative feedback, feedback voltage amplifiers, Stability study of feedback amplifier using Bode Plots.

Oscillators: The oscillation criterion, Analysis and classification of oscillator, basic principle of sinusoidal oscillators, Op-Amp RC oscillators, RC phase shift oscillator, Wein bridge oscillator, Resonant circuit oscillators, and Crystal oscillator;

Introduction to power amplifier classes: class A, class B, class AB, class C operation.

Analog IC Design: Bipolar, MOS and BiCMOS IC technology and its impact, eggshell analogy, application areas and the future of analog IC design. 555 Timer IC and its Applications, integrated power amplifiers, voltage regulators.

Noise in IC: Origin of internally developed noises in ICs. Representation of noises in circuits, noises in single stage and differential amplifiers, noise bandwidth.

Pulse circuits: Bistable multivibrator: The stable state of binary, fixed and self-biased transistor binary, commutating capacitors, unsymmetrical and symmetrical triggering of the binary, direct connected binary circuit, Schmitt trigger circuit, emitter coupled binary. Monostable multivibrator: The monostable multivibrator, gate width and waveforms of the collector coupled monostable multivibrator, the emitter coupled monostable circuit. Astable multivibrator: The collector coupled and emitter coupled astable multivibrators; their waveforms.

Recommended Books:

1. Robert Boylestad and Louis Nashelsky : Electronic Devices and Circuits
2. Ramakant A. Gayakward : Op-Amps and Linear Integrated Circuits
3. Paul R. Gray, Paul J. Hurst, Stephen H. Lewis, and Robert G. Meyer : Analysis and Design of Analog Integrated Circuits
4. J. Millman and C.C. Halkias : Integrated Electronics
5. Robert F. Coughlin : Operational Amplifier and Linear Integrated Circuits
6. Albert P. Malvino and David J. Bates : Electronic Principles
7. B. Grob : Basic Electronics
8. David A. Bell : Electronic Devices and Circuits

EEE 2122: Electronic Device and Circuit II Sessional

Credits: 1.5, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Continuous Assessment: 40%, Exam: 50%]

Sessional based on theory course EEE 2121.

ME 2111: Basic Mechanical Engineering

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment & Presentation: 10%, Exam: 70%]

Motivation : To provide a basic understanding of mechanical engineering.

Objectives : The objective of this course is to introduce the applications of thermodynamics via real-world engineering examples such as refrigeration and air-conditioning, to show students how thermodynamics is applied in engineering practice.

Course Contents

Introduction to the sources of heat energy. Renewable and non-renewable sources and their potential; Introduction to steam generation.

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

Heat engines: Classifications, working principle, applications, fuel, lubrication, cooling systems of IC engines. Thermodynamics: Review of laws of thermodynamics, analysis of different thermodynamic cycles, vapor power cycles, representation of various cycles on PV & TS planes.

Fuels and Steams: Study of fuels. Steam generation units with accessories and mountings. Study of steam generation and steam turbines. Introduction to internal combustion engines and their cycles. Study of SI and CI engines and gas turbines with their accessories.

Refrigeration: Principles of refrigeration, Types of refrigeration system, Refrigerants, their classification & desirable properties, Load calculation, Uses and application in industry.

Air-Conditioning: Principles of air-conditioning, Types of air-conditioning system, Human comfort, Summer& winter AC system, Load calculation, Applications.

Fluid Machinery: Type of fluid machinery. Study of impulse and reaction turbine. Pelton wheel and Kalpan turbine. Study of centrifugal and axial flow machines. Pumps, fans, blowers and compressors. Study of reciprocation pumps.

Books Recommended:

1. F. W. Sears& G.L. Salinger : Thermodynamics, Kinetic Theory and Statistical Thermodynamics.
2. A. Beiser : Concepts of Modern Physics
3. R.C. Jordan & G. B. Priester : Refrigeration & Air Conditioning.
4. W.H.Severns and J.R. Fellows : Air-conditioning and Refrigeration

ME 2112: Basic Mechanical Engineering Sessional

Credits: 0.75, Contact Hours/ Week: 1.5

Marks: 100 [Attendance: 10%, Continuous Assessment: 40%, Exam: 50%]

Sessional based on theory course ME 2111.

MATH 2111: Differential Equation, Laplace Transform and Fourier Analysis

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment and Presentation: 10%, Exam: 70%]

Motivation **:** To present students with essential mathematical tools for engineers like Fourier analysis, Laplace transform and linear algebra.

Objectives **:** The course will introduce the fundamentals of Fourier analysis, Laplace transform and linear algebra for engineering and applied science streams.

I L O (Intended Learning Outcomes) : Successful completion of this course should enable students to-

i. Solve engineering problems with fundamental engineering transformation techniques like Fourier and Laplace transform
ii. Apply Fourier analysis and Laplace transform in electrical circuits and communication system
iii. Improve their ability to communicate via the language of mathematics with the abstract world
iv. Apply the concepts linear algebra to real world phenomena such as electrical networks, traffic flow, archeological dating, economic interdependencies, population movement, communication networks, and weather prediction.

Course Contents

Ordinary Differential Equations: Degree and order of ordinary differential equations, formation of differential equations. Solution of first order differential equations by various methods. Solution of general linear equations of second and higher orders with constant coefficients. Solution of homogeneous linear equations. Solution of differential equations of the higher order when the dependent or independent variables are absent. Solution of differential equation by the method based on the factorization of the operators. Frobenius method.

Partial Differential Equations: Introduction. Linear and non-linear first order equations. Standard forms. Linear equations of higher order. Equations of the second order with variable coefficients. Wave equations. Particular solution with boundary and initial conditions.

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.

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.

Recommended Books:

1. P. P. G. Dyke : An Introduction to Laplace Transforms and Fourier Series
2. Joel L. Schiff : The Laplace Transform: Theory and Applications
3. Murray R. Spiegel : Schaum's Outline of Laplace Transform
4. R. J. Beerends : Fourier and Laplace Transforms
5 S. L. Ross : Introduction of Ordinary Differential Equations
6 F. Ayres : Differential Equations
7 B. D. Sharma : Differential Equations

HUM 2111: Accounting and Economics for Engineers

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment and Presentation: 10%, Exam: 70%]

Motivation: To know basic theory of accounting, its applicability in real world situations.

Course Objective: The courses in the undergraduate programs are designed to give students a rigorous and comprehensive academic training on the basic knowledge of accounting and economics. A student in EEE must have a sound basis in the fundamentals of accounting and economics but also should be aware of socio-economic problems of the country.

Course Contents

Accounting: Definition, advantages, objects; nature of transaction; double entry system of book-keeping, classification of account, accounting principles.

Accounting cycle: Journal, ledger, trial balance, adjusting entries.
Final accounts: Trading & manufacturing accounts, profit and loss accounts and balance sheet.

Depreciation: Definition, advantages, objects; Methods of depreciation and application.

Costing: Concept of cost, classification of cost, cost-sheet, distribution of overhead to the various cost center/ departments, calculation of departmental overhead rate and machine hour rate; job costing: preparation of job cost-sheet and quotation. Marginal costing & profit volume/ratio, operating cost.

Economics: Definition, scope and methods. Demand, supply and their elasticity's; equilibrium analysis-partial and general; consumer behavior, marginal utility; indifference curve, consumer's surplus; producer behavior; iso-quant, iso-cost line. Factors of production function; production possibility curve; fixed cost and variable cost; short run and long run costs, total, average and marginal cost; laws of returns; internal and external economics and diseconomies; market and market forms; perfect and imperfect competition; price output determinations. Introductory ideas on GNP, GDP, perceptual income, interest, rent, saving, investment, inflation; project approval, NPV, IRR and their application, cost benefit analysis.

Books Recommended

1. Management, Harold Koontz, McGraw-Hill.
2. Account Principle, Weygandt, Kieso & Kimmel, John Wiley & Sons, Inc.
3. Entrepreneurship Development, Nazrul Islam and Muhammad Z Mamun, The University Press Limited.
4. Entrepreneurship Development, An Indo-German Technical Cooperation Project.
5. Roger A Arnold: Economics. West publishing company, 1989
6. P.A. Samuelson and WD. Nordhaus: Economics, McGraw-Hill, latest edition

EEE 2100: Circuit Simulation Sessional

Credits: 1.5, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Continuous Assessment: 40%, Exam: 50%]

In this course students will verify theories and concepts learned in electrical and electronic circuit theory courses using simulation software(s). PSPICE, MATLAB, PROTEUS and other simulation software will be introduced.

2nd Year 2nd Semester

EEE 2211: Electrical Machine II

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment and Presentation: 10%, Exam: 70%]

Motivation : To develop a solid background on transformer and induction motors.

Objectives : This course intends to provide conception to work with two widely used electrical machinery induction motors. Both single phase and polyphase machines will be discussed in detail with regard to their construction, classification, connections, input/output, losses and efficiency.

I L O (Intended Learning Outcomes) : Successful completion of this course should enable students to-

i. Analyze the construction and operation of different induction motors
ii. Analyze the areas of applications for different types of machines including alternator and synchronous motor studied
iii. Realize the impact of efficiency and regulation of the machines
iv. Solve problems associated with the use of induction machines
v. Solve problems associated with the design of alternator and induction machines.

Course Contents

Single Phase Induction Motor: Principle, Construction and types, Performance, Double revolving field theory, Cross field theory, Equivalent circuits.

Polyphase Induction Motor: Principle of operation, Constructional details, Classifications, Equivalent circuits, starting torque and maximum torque, Speed-torque relations, Losses and efficiency, Circle diagram, Starters, Methods of speed control, Methods of braking and plugging, Induction generator.

Synchronous Generator: Alternator construction. Armature winding, air gap flux and voltage compensation. Determination of machine parameters. Vector diagram and alternator regulation by different methods. Parallel operation: necessary condition, synchronizing, circulating current. Transient condition of alternator, transient and sub-transient reactance, Blondel's two reaction analysis. Power balance, loss and efficiency.

Synchronous Motor: Characteristics operation and vector diagram. Effect of excitation on power factor and motor performance. Application and testing of synchronous motor. Synchronous capacitor and power factor improvements.

Special Machines: Welding machine, Brushless machines, universal motor, stepper motor, reluctance motor, repulsion motor, servomotor, Hysteresis motor, permanent magnet motor and electrostatic motor.

Electro mechanical energy conversion: Principles of electro-mechanical energy conversion, energy balance equation, energy in singly excited magnetic systems, mechanical force and energy.

Recommended Books:

1.	Stephen J. Chapman	:	Electric Machinery and Power System Fundamentals
2.	A Fitzgerald	:	Electric Machinery
3.	A. Puchstein, T E Loyd and AG Conard	:	Alternating Current Machines
4.	J. Rosenblatt & M. H. Friedman	:	Direct and Alternating Current Machinery
5.	Charles I Hubert	:	Electric Machines: Theory, Operating Applications, and Controls
6.	B.L. Thereja, A.K. Thereja	:	A Textbook of Electrical Technology, Volume II
7.	Er. R.K. Rajput	:	Electrical Machines in S.I. UNITS
8.	J.B. Gupta	:	Electrical Machines (AC and DC Machines)
9.	M.A. Salam	:	Fundamentals of Electrical Machines

EEE 2212: Electrical Machine II Sessional

Credits: 1.5, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Continuous Assessment: 40%, Exam: 50%]

Sessional based on theory course EEE 2211.

EEE 2231: Digital Electronics

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment and Presentation: 10%, Exam: 70%]

Motivation : To introduce students with the digital system, their design and applications in real world.

Objectives : This course deals with digital logic design with an emphasis on practical design techniques and circuit implementations.

I L O (Intended Learning Outcomes) : Successful completion of this course should enable students to-

i. Understand the characteristics of digital logic families and their operations
ii. Explain the concept behind the digital devices
iii. To design the logic gates, flip-flop, clock circuit, synchronous counter, asynchronous counter, registers and memory units.

Course Contents

Introduction to Number Systems and Logic Gates: number systems, number base conversions, complements, binary codes, BCD numbers, Boolean algebra, postulates and theorems, basic logic functions, digital logic gates, logic families (DL, DTL, TTL, ECL, BiCMOS)

Minimization and Implementation of Boolean Functions: Forms of Boolean functions, canonical and standard forms, Shannon's theorem, Minimization of Boolean functions using Karnaugh map, Quine McCluskey method, Iterative consensus method, Implementation of switching functions (Using various gates: NOR, NAND, AND - OR- INVERT).

M**odular Combinational Circuit Design**; pass transistor, pass gate, Half adder, Full adder, multiplexer, demultiplexer, decoder, encoder, binary arithmetic elements and ALU design.

Converters: Digital to analog conversion, D/A converter circuitry, DAC specifications and applications, Analog to digital conversion, Digital ramp ADC. A/D resolution and accuracy.

Sequential Logic: Difference between combinational circuits and sequential circuits, Types of sequential circuit, Flip-Flops (Basic flip-flop circuit, clocked RS flip-flop, D flip-flop, JK flip-flop, T flip-flop), Triggering of Flip-flop, Analysis of clocked sequential circuits (state table, state diagram, state equations), state reduction, state assignment.

Counter Design: Types of counters, Design of synchronous and asynchronous counter, MOD number, propagation delay in Ripple counter, Ring counter, The Johnson Counter,

Register and Memory Unit: Basic shift register, Serial In/Serial out shift registers, Serial In/Parallel out shift register, Parallel In/Serial out shift register, Bidirectional shift register, Memory: Integrated circuit memory, Classification and architecture, RAM memory cells, Read only memory, Magnetic core memory.

MOSFET Digital Circuits: NMOS inverter, CMOS inverter, CMOS logic circuits, Clocked CMOS logic circuits, transmission gates.

Recommended Books:

1. Thomas L. Floyd : Digital Fundamentals

2. A.P.Godse, D.A.Godse : Digital Electronics And Logic Design

3. M. Morris Manno : Digital and Computer Design
4. Tocci and Widmer : Digital Systems
5. V.K. Jain : Switching Theory and Digital Electronics
6. S.C. Lee : Digital Circuit and Logic Design

EEE 2232: Digital Electronics Sessional

Credits: 1.5, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Continuous Assessment: 40%, Exam: 50%]

Sessional based on theory course EEE 2231.

EEE 2241: Computational Methods for Engineers

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment and Presentation: 10%, Exam: 70%]

Motivation : To guide students with computer aided mathematical modeling and problem solving in reference to electrical engineering.

Objectives : This course will introduce the fundamentals of numerical methods for engineering and applied science streams. The goal of the course is to provide a broad background in numerical methods with theoretical discussion and appropriate software like MATLAB to be used for applying the discussed algorithms in solving practical engineering problems.

I L O (Intended Learning Outcomes) : Successful completion of this course should enable students to-

i. Construct polynomial approximations to functions by interpolation;
ii. Use numerical techniques for differentiation and integration;
iii. Solve non-linear equations by iteration;
iv. Solve ordinary and partial differential equation by numerical methods;
v. Write MATLAB codes to implement numerical algorithms.

Course Contents

Computational Methods: Computer Algorithm, Mathematical modeling of physical systems. Approximations and Errors: Accuracy and precision, Error definitions, Round-off errors, Truncation errors. Introduction to MATLAB programming: control statements, looping, matrices and vector operations, functions.

Solution of Algebraic and Transcendental Equations: Bisection method, method of false position, fixed point iteration method, Newton-Raphson method, Ramanujan's method, Muller's Method, Bairstow's Method.

Curve Fitting: Newton Gregory forward and backward interpolations, Gauss' central difference interpolation formula, Stirling's interpolation formula, Bessel's formula, Everett's formula, Lagrange interpolation formula, Lagrange inverse interpolation formula, Newton's general interpolation, cubic spline interpolation, Lease square approximations.

Numerical Differentiation and Integration: Numerical differentiations with different interpolations, Numerical integrations by Trapezoidal rule, Simpson's rules, Boole's and Weiddle rules, Romberg method.

Numerical Solutions of Linear and Nonlinear Systems of Equations: matrix inversion method, Gauss' elimination method, Gauss-Gordan method, tridiagonal system, Gauss-Seidel Method, Newton's Method.

Numerical Solutions of Ordinary Differential Equations: Taylor's series method, Picard method of successive approximations, Euler and modified Euler's method, Predictor-Corrector method, finite difference, shooting method, Runge-Kutta Methods.

Numerical Solutions of Partial Differential Equations: Laplace equation by Jacobi's method, Gauss-Seidel method, SOR method, parabolic and hyperbolic equations by explicit and implicit finite difference technique.

Application of the above techniques in Electrical and Electronic Engineering through computer program.

Recommended Books:

1. Steven Chapra and Raymond P. Canale : Numerical Methods for Engineers
2. S.S. Sastry : Introductory Methods of Numerical Analysis
3. E. Balagurusamy : Numerical Methods
4. Stephen J. Chapman : MATLAB Programming for Engineers
5. Brian R. Hunt : A Guide to MATLAB: For Beginners and Experienced Users
6. JaanKiusalaas : Numerical Methods in Engineering with MATLAB
7. Sergey E. Lyshevski : Engineering and Scientific Computations Using MATLAB

EEE 2242: Computational Methods for Engineers Sessional

Credits: 0.75, Contact Hours/ Week: 1.5

Marks: 100 [Attendance: 10%, Continuous Assessment: 40%, Exam: 50%]

Sessional based on theory course EEE 2241.

IPE 2211: Industrial Management

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment & Presentation: 10%, Exam: 70%]

Motivation: To know the basic knowledge about industrial management in the real-world situations.

Course Objective: This course aims introduce the basic knowledge about the industrial and organization management system.

Course Contents

Introduction: Evolution and various thoughts of management, Importance of industrial management and application, Organization and environment.

Organization: Theory and structure, Co-ordination, Span of control, authority, Delegation, Centralization and decentralization, Inventory system.

Personal Management: Need hierarchy, Motivation, Leadership, Performance, appraisal, wages and incentives, Wages payment system, Labour cost and variance, Organizational change and conflicts.

Managerial Accounting: Elements of costs of products Evaluation, Break even analysis, Flexible Budget, Master Budget.

Operational Management Accounting for Engineers: Forecasting, inventory management Accounting, EOQ, ABC analysis, MRP and JIT, Master planning, basic scheduling technique, CPM and PERT, Plant location and layout, Maintenance management, Manage information system (MIS), Computer aided process planning (CAPP), Manufacturing resource planning (MRP- II).

Recommended Books:

1. Henri Fayol : General and Industrial management
2. Gideon Halevi : Industrial Management- Control and Profit
3. **প্রফেসর ড. মোঃ আলতাফ হোসেন** : **ইন্ডাস্ট্রিয়াল ম্যানেজমেন্ট**
4. Dipak Kumar Bhattacharyya : Industrial Management

STAT 2211: Statistics for Engineers

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment and Presentation: 10%, Exam: 70%]

Motivation: To know basic theory of statistics and its applicability in real world situations.

Course Objective: This course aims introduce statistics and its applications for science and engineering student. The objective is intended for students to solve some practical by statistical methods. It will help students develop skills in thinking and analyzing problems from a probabilistic and statistical point of view.

Course Contents

Descriptive statistical data: Meaning and scope of statistics, Sources and type of statistical data, Representation of statistical data, Location, Dispersion and their measures. Skewness, Kurtosis and their measures. Moment and Cumulants and Practical examples.

Probability: Concept of probability. Sample Space, Events union and Intersection of Events. Probability of events. Laws of probability, Conditional probabilities, Bayes' Theorem, Chebyshev's Inequality and Practical examples.

Random variables and probability Distribution: Basic concepts, Discrete and continuous random variables, Density and distributional functions, Mathematical expectation and variance, Joint marginal and conditional density functions, Conditional Expectation and conditional variance, Moments and Cumulant generating functions. Characteristic function. Study of Binomial, Poisson, Normal and Bivariate Normal distribution and Practical examples.

Linear Regression and Correlation: Correlation, Rank correlation, Partial and Multiple correlations. Linear Regression for two variables. Principle of Least Squares Method. Lines of best fit Residual Analysis and examples.

Decision Rules: Statistical decisions; Statistical hypothesis; Critical region, Best critical region; Two types of errors; procedure of Test of hypothesis; Most powerful test, standard Errors.

Recommended Books:

1. A. J. B. Anderson : Interpreting Data, Chapman and Hall, London
2. H. Cramer : The Elements of Probability Theory. Wiley, N. Y
3. P. Hoel, : Introductory Statistics, Wiley and Sons, N. Y.
4. D. V. Lindley : Introduction to Probability and Statistics, Vol-1 C. U. P. London
5. S. Lipschutz : Probability, McGraw-Hill, N. Y.
6. Mood, Graybill and Boes : Introduction to the Theory of Statistics, McGraw-Hill, N. Y.
7. Gutman, Wilks and Hunter : Introductory Engineering Statistics, John Wiley and Sons.

EEE 2200: Electrical and Electronic Shop Practice

Credits: 1.5, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Continuous Assessment: 40%, Exam: 50%]

Course Contents

Familiarization with CAD tools for building services design. Introduction to building regulations, codes and standards: BNBC, NFPA etc. Terminology and definitions: fuses, circuit breakers, distribution boxes, cables, bus-bars and conduits. Familiarization with symbols and legends used for electrical services design. Classification of wiring. Wattage rating of common electrical equipment.

Electrical installations system design: substations, Busbar trunking and protection, air-conditioning, heating and lifts. 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.

Wire specification: Flexible wire: Electrical cables: T&T cables; fuse wire, etc. Safety devices: Fuse wires; MCCB; fuse distribution board (FDB); oil circuit breaker, air circuit breaker, etc. Motor winding, fans and regulator repairing, transformer winding, etc.

Electrical wiring: Illumination, house wiring, industrial installation wiring, estimation for electrical wiring system, safety rules, wiring of air conditioning, designing underground cable, erection estimation, electricity rules, electricity codes, tariff of PDB and REB

Earthing requirements, various earthing methods. Earthing and lightning protection system design.

Testing: Megger test, fan and transformer test, earthing and its testing.

Introduction to formal procedures of preventive maintenance, Circuit tracing, trouble shooting, fault repairing, soldering and de-soldering of electronic circuits, Design of PCB layout, etching.

Radio receivers: Principles of operations, circuit tracing, fault finding by signal injection alignment, TV camera, B/W TV, color TV, CD and VCD player.

Recommended Books:

1. Neil Sclater, John E. Traister : Handbook of Electrical Design Details
2. R P Singh : Electrical Workshop: A Textbook
3. Mohamed A. El-Sharkawi : Electric Safety: Practice and Standards

4. Keith Mobley, Lindley Higgins and Darrin Wikoff : Maintenance Engineering Handbook
5. Tim Williams : The Circuit Designer's Companion
6. Marcus and Lavy : Elements of Radio Servicing
7. Mark I. Monstrose : A Handbook for Designers

3rd Year 1st Semester

EEE 3111: Measurement and Instrumentation
Credits: 3, Contact Hours/ Week: 3
Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment and Presentation: 10%, Exam: 70%]

Motivation : To offer an understanding of measuring instruments and techniques.

Objectives : This course intends to give idea about the significance of measurement and the analysis of the instrumentation for measurement.

I L O (Intended Learning Outcomes) : Successful completion of this course should enable students to-

i. Familiarize with the Construction of various measuring instruments.
ii. Comprehend the theoretical analysis of operation of the measuring instruments.
iii. Realize different form of Instrumentation.
iv. The application of these measurement instruments from a practical perspective.

Course Contents

Introduction: Methods of measurement, Statistical method applied to field of measurement and error analysis and calibration.

Resistance, Inductance and Capacitance Measurement: Different Methods of measuring high, medium and low resistances. Methods of measuring self and mutual inductance and capacitance measurement. A.C and D.C bridge methods, Measurement of insulation and earth resistances, Localization of cable fault.

Magnetic Measurement: Ballistic galvanometer, Tangent galvanometer, D-Arsonval galvanometer, Flux meter, Flux and Flux density measurement, Determination of iron losses and their separation. Speed, frequency and phase difference measurement. Illumination measurement.

Measuring Instruments: Classification of measuring instruments, Ammeter, Voltmeter, wattmeter, AVO meter, Energy meter, Ampere-hour meter and Maximum demand meter for measuring AC and DC quantities.

Electronic Measuring instruments: Digital instruments, VTVM, Q-meter and CRO.

Instrumentation: Extension of instrument range, Use of C.T and P.T and calculation of their burden, Instrumentation of substation. Transducer-mechanical, electrical and optical.

Measurement of Non-Electrical Quantities: Measurement of temperature, pressure, displacement, velocity acceleration. Strain gauge and their applications.

Recommended Books:

1. A.K. Sawhney : Electrical and Electronic Measurement and Instrumentation
2. U.A. Bakshi and A.V. Bakshi : Electrical Measurements and Instrumentation

3. Alan S. Morris : Measurement and Instrumentation Principles
4. Robert B. Northrop : Introduction to Instrumentation and Measurements

EEE 3112: Measurement and Instrumentation Sessional

Credits: 1.5, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Continuous Assessment: 40%, Exam: 50%]

Sessional based on theory course EEE 3111.

EEE 3121: Engineering Materials

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment & Presentation: 10%, Exam: 70%]

Motivation : To provide a deeper understanding of advanced engineering materials.

Objectives : This course introduces the characteristics and applications of engineering materials. Emphasis is on analysis, selection, design and troubleshooting.

I L O (Intended Learning Outcomes) : Successful completion of this course should enable students to-

i. Introduce to the elementary materials science concepts

ii. Know about the elementary quantum physics.

iii. Study about the dielectric materials ant its applications.

iv. Study about the different properties including magnetic and optical properties of materials.

Course Contents

Elementary materials science concepts: Bonding and types of solids, crystalline state, crystalline defects and their significance, electrical and thermal conduction in solids, scattering, classical-Drude model, Mathiessen's rule, failure of classical theory in modern devices, introduction to quantum transport theory.

Elementary quantum physics: Photons, electron as a wave, time-independent Schrodinger equation, Heisenberg's uncertainty principle, modern theory of solids, band theory of solids, E-K diagram & its physical meaning, density of states, electron effective mass from E-K diagram, direction dependent effective mass (Effective mass tensor). Statistics-Boltzmann and Fermi-Dirac statistics, Fermi energy significance.

Dielectrics: Matter polarization and relative permittivity, electronic polarization- covalent solids, polarization mechanisms, polar and nonpolar dielectrics, Langevin's theory of polarization, Clausius-Mossotti equation, interaction between field and matter, frequency dependent dielectric constant and dielectric loss, Gauss's law, dielectric strength and insulation breakdown, piezoelectricity, ferroelectricity and pyroelectricity.

Magnetic properties: Magnetization, dipole and atomic moment, magnetization vector, field intensity, permeability and susceptibility, magnetic moments, diamagnetic, paramagnetic, ferrimagnetic, ferromagnetic and antiferromagnetic materials and their applications, magnetic domains,

polycrystalline and permanent magnetic materials, soft and hard magnetic materials, magnetic recording materials.

Superconductivity: Zero resistance and Meissener effect, Type-I and Type-II superconductors, origin of superconductivity.

Optical properties: Interaction of light with solids, refractive index, dispersion, Fresnel's equations, light absorption and scattering, polarization, optical anisotropy, birefringent, electro-optic effect. Introduction to nanotechnology and nanomaterials, organic materials and their applications in devices.

Recommended Books:

1. Robert Boylestad and Louis Nashelsky : Electronic Devices and Circuits
2. S. O. Kasap Principles of Electronic Materials and Devices
3. Paul R. Gray, Paul J. Hurst, Stephen H. Lewis, and Robert G. Meyer : Analysis and Design of Analog Integrated Circuits
4. J. Millman and C.C. Halkias : Integrated Electronics
5. Introduction to Electronic Materials & Devices Prof. Sin-Doo Lee
6. Albert P. Malvino and David J. Bates : Electronic Principles
7. B. Grob : Basic Electronics
8. David A. Bell : Electronic Devices and Circuits

EEE 3131: Microprocessor and Microcontroller

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment and Presentation: 10%, Exam: 70%]

Motivation: To develop knowledge on architecture of Microprocessor and Microcontroller, programming skills with Microprocessor and Microcontroller, and the basics of PLC.

Course Objective: This course introduces to Engineering Graduates the Microprocessor and its Assembly Language programming. The course is designed based on the popular Intel 8086 microprocessor and provides good understanding of the microprocessor operation at the address, data, and control level. The course also covers the software part through teaching of assembly language programming techniques. Microprocessor Interface hardware and support chips are also examined in detail. This course also provides basic knowledge on 8051 Microcontroller and PLC.

Course Contents

Microprocessor Fundamentals: Concept of Microprocessor and microcontroller, Evolution of microprocessor and Microcontroller, Application of microprocessor and Microcontroller, Architecture of a microprocessor, Data bus, address bus, control bus, I/O units and memory. Architecture of Intel 8086 Microprocessor, its execution unit and bus-interface unit, its registers and flags.

Programming Model: Programming model of 8086 processor, segment-offset address and physical address calculations, even and 1st addressing, introduction of different addressing modes, Introduction to Assembly Language, Assembly Language syntax, Program Data, Variables, Named constants, program structure, memory models, Input/ Output instruction, Running program, Program Segment Prefix. The processor status and the Flag register, Overflow condition, Debugging a program, Flow control operations, Arithmetic and logical operations, Arrays, String manipulations.

Next Generation Microprocessors: Intel Core architecture, Intel dual core, core 2 duo, core 2 quad, core i3, core i5, core i7, mobile microprocessors, ARM, helio, atom.

Microcontrollers: Microcontroller & embedded systems, 8051 microcontroller architecture, operation and instruction set, memory and I/O interfacing, interfacing to external devices.

Programmable Logic Controller (PLC): Basic Structures, I/O, Programming, Mnemonics and Timers, Relays and Counters, Master and Jump control, Data Control, Analog I/O Control.

Recommended Books:

1. Ytha Yu and CharlersMarut : Assembly Language Programming and Organization of the IBM PC, McGraw- Hill
2. K. J. Ayala : The 8051 Microcontroller: Architecture, Programming and Applications
3. Rafiquzzaman : Microprocessor and Microcomputer based System Design Crc Press Publication
4. D. V. Hall : Microprocessors and Interfacing, McGraw-Hill
5. Ramesh Goanker : Microcomputer Interfacing, McGraw-Hill

EEE 3132: Microprocessor and Microcontroller Sessional

Credits: 1.50, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Continuous Assessment: 40%, Exam: 50%]

Sessional based on EEE 3131.

EEE 3141: Power Electronics

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment and Presentation: 10%, Exam: 70%]

Motivation : To learn the design and operation of high-power electronic drives and devices.

Objectives : This course intends to give idea about power electronic devices like, thyristor, DIAC, TRIAC, UJT, Rectifiers, Controllers, and Inverters etc. The operation, performance measurement and design of schemes with regard to power electronic devices will be taught.

I L O (Intended Learning Outcomes) : Successful completion of this course should enable students to-

i. Understand the characteristics and usage of power electronic switches and devices
ii. Analyze the performance of uncontrolled and controlled rectifiers for both single phase and three phase system.
iii. Analyze the operation and performance of different voltage controllers and converters
iv. Analyze the performance of different inverters.

Course Contents

Power Semiconductor Switches and Triggering Devices: BJT, MOSFET, SCR, IGBT, GTO, TRIAC, UJT and DIAC.

Uncontrolled Rectifiers: Single-Phase Half-Wave rectifier, Performance parameters, Single-Phase Full-Wave Rectifiers with R load and RL load, Three-Phase Full-Wave Rectifiers with R load and RL load.

Single-Phase Controlled Rectifiers: Thyristor Characteristics and Applications, Two Transistor model of Thyristor, Thyristor Turn-On and Turn-Off, Thyristor types. Phase Controlled Converter operation,

Single-Phase Full Converters with R Load and RL load, Single-Phase Dual Converters and Semi converters.

Three-Phase Controlled Rectifiers: Three-Phase Half-Wave Converters, Three-Phase Full Converters with R load and RL load, Three-Phase Dual Converters and Semi Converters, Power Factor Improvements, Twelve-Pulse Converters.

DC-DC Converters: Generation of Duty Cycle, Step-Down Converter, Step-Up Converter, Converter Classification, Switching-Mode Regulators: Buck regulators, Boost Regulators. Buck-Boost Regulators, Cuk Regulators.

Pulse-Width-Modulated Inverters: Principle of Operation, Single-Phase Bridge Inverters, Three-Phase Inverters: 180-Degree Conduction, 120-Degree Conduction.

Resonant Pulse Inverters: Series and Parallel Resonant Inverters, Zero-Current Switching and Zero-Voltage-Switching Resonant Converters, Comparisons between ZCS and ZVS Resonant Converters.

AC voltage Controllers: Principle of On-Off Control, Principle of Phase Control, Single Phase Controllers with Resistive and Inductive load, Three-Phase Full-Wave Controllers, Three Phase Full-Wave Controllers, Three Phase Bidirectional Delta-Connected Controllers, Single-Phase and Three-Phase Cycloconverters.

Recommended Books:

1. Muhammad H. Rashid : Power Electronics
2. Ned Mohan and Tore M. Undeland : Power Electronics
3. P. C. Sen : Power Electronics
4. G.K. Mithal : Industrial Electronics

EEE 3142: Power Electronics Sessional

Credits: 0.75, Contact Hours/ Week: 1.5

Marks: 100 [Attendance: 10%, Continuous Assessment: 40%, Exam: 50%]

Sessional based on theory course EEE 3141.

EEE 3151: Signals and Linear Systems

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment and Presentation: 10%, Exam: 70%]

Motivation : To prepare students for the mathematical study of signals and linear system.

Objectives : This course is designed to use the background of mathematics to analyze linear system in related with electrical engineering. Students will also be introduced with modern filter design and application areas.

I L O (Intended Learning Outcomes) : Successful completion of this course should enable students to-

i. Realize and develop simple mathematical models for representing signals and systems;
ii. Understand the relationship between time and frequency domain models of dynamic systems;
iii. Convert time to frequency-domain models and vice versa;
iv. Understand the relationship between analog electrical and mechanical models;
v. Apply the ideas learned so-far to design modern filters.

Course Contents

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, invertibility.

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.

Laplace Transformation and its applications: Properties, inverse transform, solution of system equations, system transfer function, system stability and frequency response and application.

Frequency Domain Analysis of LTI Systems: Fourier series- properties, harmonic representation, system response, frequency response of LTI systems;

Fourier Transformation and its applications: Properties, system transfer function, system response and distortion less systems.

Applications of Time and Frequency Domain Analyses: Solution of analog electrical and mechanical systems, amplitude modulation and demodulation, time-division and frequency-division multiplexing.

Analog Filters: Filter equations, modern filters.

Recommended Books:

1.	Simon Haykin and Barry van Veen	:	Signals and Systems
2.	B. P. Lathi	:	Signal Processing and Linear Systems
3.	D. K. Cheng	:	Analysis of Linear Systems
4.	Charles K. Alexander and Mathew N. O. Sadiku	:	Fundamentals of Electric Circuits
5.	Hwei P. Hsu	:	Schaum's Outline of Signals and Systems

EEE 3100: Electrical Machine Design

Credits: 0.75, Contact Hours/ Week: 1.5

Marks: 100 [Attendance: 10%, Continuous Assessment: 40%, Exam: 50%]

Specification and design of electromagnets, solenoids, chokes, transformers and induction motors.

3rd Year 2nd Semester

EEE 3211: Communication Engineering I

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment and Presentation: 10%, Exam: 70%]

Motivation : To teach students the fundamentals of modern communication system.

Objectives : This course is structured to present the fundamental communication principles and the application of these principles to contemporary analogue and digital communication systems. Students learn basic concepts associated with information, coding, modulation, detection, and signal processing in the presence of noise. Students will also be familiarized with the radio and television system.

I L O (Intended Learning Outcomes) : Successful completion of this course should enable students to-

i. Identify and differentiate between different transmission types and transmission media.
ii. Describe in details the modulation and demodulation of analog communication system.
iii. Apply the knowledge of basic analog modulation in radio system.
iv. Analyze the transmission channel mathematically along with different coding schemes for digital transmission.
v. Explore the modern television system.

Course Contents

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. Delta modulation and demodulation.

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.

Introduction to 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.

Waveform Coding Techniques: Sampling- sampling theorem, Nyquist criterion, aliasing, instantaneous and natural sampling, flat-topped sampling; message reconstruction rom its samples, PAM, PCM, quantization noise, channel noise, SNR, robust quantization, differential PCM, delta modulation (DM)-principle, adaptive DM; line coding- formats and bandwidths.

Digital Modulation and Demodulation 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.

Multiplexing: Space division multiplexing, frequency division multiplexing, time division multiplexing, and code division multiplexing.

Multiple-access techniques: Time-division multiple-access (TDMA), frequency-division multiple access (FDMA); code-division multiple access (CDMA) - spread spectrum multiplexing, coding techniques and constraints of CDMA.

Recommended Books:

1. B. P. Lathi : Modern Digital and Analog Communication System
2. Simon Haykin Digital Communication Systems
3. Kennedy and Davis : Electronic Communication Systems
4. Roddy and Coolen : Electronic Communications
5. G. K. Mathur : Radio Engineering
6. B. Grob : Basic TV
7. Gulati : Monochrome and Color TV

EEE 3212: Communication Engineering I Sessional

Credits: 1.5, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Continuous Assessment: 40%, Exam: 50%]

Sessional based on theory course EEE 3211.

EEE 3221: Power System I

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment and Presentation: 10%, Exam: 70%]

Motivation : To enrich students with fair knowledge of the traditional Electrical Power System.

Objectives : This course has been designed to introduce students with the Electrical Power Systems in regards to network representation, single-line diagram, load flow analysis, fault analysis and protective schemes for power system.

I L O (Intended Learning Outcomes) : Successful completion of this course should enable students to-

- **i.** Calculate the inductance and capacitance of transmission line.
- **ii.** Get accustomed with per-unit system, single line diagram and different methods for load flow studies.
- **iii.** Differentiate between various transmissions lines with respective modeling circuit.
- **iv.** Calculate the fault current and the severity of fault in different transmission system.
- **v.** Choose and characterize different conventional protective devices and schemes.

Course Contents

Network Representation: Single line and reactance diagram of power system and per unit system.

Line Representation: Equivalent circuit of short, medium and long lines, reactive power compensation of lines, introduction to DC transmission.

Load Flow Studies: Gauss-Seidel and Newton Raphson methods, Power flow control: Tap changing transformer, phase shifting, booster and regulating transformer and shunt capacitor.

Fault Analysis: Transient and sub-transient reactance and Short circuit current of a synchronous machine. Symmetrical fault calculation, symmetrical components, sequence impedance and sequence networks of generators, transformers and lines. Different types of unsymmetrical faults: solid faults and faults through impedance. Unsymmetrical fault calculation.

Protection: Fault level calculation, selection of circuit breakers, introduction to relays and circuit breakers. Typical layout of a substation.

Recommended Books:

1. William D. Stevenson Jr. : Elements of Power System Analysis
2. V.K. Mehta and Rohit Mehta : Principles of the Power System
3. Kothari and Nagrath : Power System Engineering
4. Ashfaq Husain : Electrical Power Systems
5. HadiSaadat : Power System Analysis

EEE 3222: Power System I Sessional

Credits: 0.75, Contact Hours/ Week: 1.5

Marks: 100 [Attendance: 10%, Continuous Assessment: 40%, Exam: 50%]

Sessional based on theory course EEE 3221.

EEE 3231: Power Plant Engineering and Environmental Issues

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment and Presentation: 10%, Exam: 70%]

Motivation : To introduce students with modern power plants and their economic operation.

Objectives : This course intends to give idea about various types of electrical power plants, analysis of practical power plant under normal operating conditions at optimum cost.

I L O (Intended Learning Outcomes) : Successful completion of this course should enable students to-

i. Describe the construction and perform necessary study on power station.
ii. Describe the operation of different types of elements used in power station
iii. Become efficient Power System/Power Plant/Electrical Engineers.

Course Contents

Power Plants: Types, Thermal power station- general layout of a thermal power plant, heat rate, incremental heat rate, efficiency, capacity scheduling, load division; principles and construction of gas turbine, steam turbine, diesel, combined cycle, hydro and nuclear, and magneto-hydrodynamic power plants.

Variable load problems, plotting and analysis of load curves, chronological load curves and load duration curve. Energy load curve and its use. Load factor, capacity factor, demand factor, utilization factor, diversity factor etc. and their impact over the cost analysis of power generation and utilization. Load forecasting, selections of units and plant location.

Load Sharing: Base load and peak load plants. Use of chronological load curves to distribute load among units.

Power Plant Economics: Economic operation of power plants. Input output curve, heat rate curve, incremental rate curve. Use of incremental rate curve for optimum load scheduling. Transmission line loss, determination of loss co-efficient. Economic conductor selection, Kelvin's law. Graphical method for location of distribution systems. Tariff and tariff design. Bus system. Importance of power control. Current limiting reactors. Different types of bus system layout. Forces on bus section in case of short circuit.

Environmental Issues: Environmental Issues for Electrical Engineers, Concept of an ecosystem, Environmental Pollution, Energy and the environment, and Environmental Issues of Nuclear Power Plant.

Recommended Books:

1. William A. Vopat : Power Station Engineering and Economy
2. P. K. Nag : Power Plant Engineering
3. Bernhardt G.A. Skrotzki, W.A. : Power Station Engineering and Economy

Vopat

EEE 3241: Control System

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment and Presentation: 10%, Exam: 70%]

Motivation : This course will introduce the theory and application of modern control system.

Objectives : In this course student will learn about 'Control System' in regards to linear system models, system block diagrams and signal flow graphs, stability, time response, steady-state error, dynamic compensation, root locus analysis and design, frequency response analysis and design.

I L O (Intended Learning Outcomes) : Successful completion of this course should enable students to-

i. Understand basic concept behind control of systems
ii. Estimate system performance
iii. Analyze simple non-linear systems
iv. Analyze stability of system
v. Design simple practical systems with desired outcome.

Course Contents

Introduction to control system, classification and application of control systems. Review of Laplace transform, Initial and Final value theorems.

Transfer Functions: Open-loop stability, Poles, Zeros, Time response, Transients, Steady-state, Block diagrams and signal flow diagrams. Feedback Principles: Open versus Closed-loop control, High gain control, Inversion.

State Variables: State variable characterization of systems, transition matrix, canonical forms. Signal flow diagram to state variables, transfer function to state variable and state variable to transfer function. Controllability and observability.

Stability of Closed-loop Systems: Bounded-input bounded-output (BIBO) stability, Routh-Hurwitz stability criterion, Stability in State Space, Root locus.

Pole Assignment: Sylvester's theorem, PI and PID synthesis using pole assignment.

Frequency Response: Nyquist plot, bode diagram, Nyquist stability theorem, Stability margins, Closed-loop sensitivity functions, Model Errors: System Type, sensitivity, and Steady-state Error, Robust stability.

PID Control: Structure, Design using root locus, Proportional control, Lead-lag control, PID control, Digital control systems: introduction, sampled data systems, stability analysis in Z-domain.

Programmable Logic Controllers: Introduction, purpose, functions, and operations of the PLC in industrial applications, Introduction to PLC ladder logic and basic programming concepts.

Recommended Books:

1. Norman S. Nise : Control Systems Engineering
2. Katsuhiko Ogata : Modern control engineering
3. FaridGolnaraghi, Benjamin C. Kuo : Automatic Control Systems
4. I.J. Nagrath : Control Systems Engineering

5.	R. C. Dorf and R. H. Bishop	:	Modern Control Systems
6.	Bernard Friedland	:	Control System Design: An Introduction to State-Space Method
7.	Kelvin T. Erickson	:	Programmable Logic Controllers: An Emphasis on Design and Application

EEE 3242: Control System Sessional

Credits: 1.5, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Continuous Assessment: 40%, Exam: 50%]

Sessional based on theory course EEE 3241.

EEE 3251: Engineering Electromagnetics

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment and Presentation: 10%, Exam: 70%]

Motivation : To implement the knowledge of mathematics for understanding electromagnetic wave propagation through different media.

Objectives : In this course student will get comprehensive idea about electromagnetism, Maxwell equation, static electric fields, magneto statics, time varying electric fields, antenna, wave guide, and transmission line.

I L O (Intended Learning Outcomes) : Successful completion of this course should enable students to-

i. Apply basic laws of electromagnetics to find the E-field and H-field distribution of certain geometry
ii. Use Maxwell's equation to understand the mechanism for propagation of EM wave
iii. Analyze different phenomena associated with EM wave
iv. Get introduced with basic antenna fundamentals and different antenna parameters
v. Describe the transmission of EM waves through waveguides and transmission.

Course Contents

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 terms 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 and Poynting theorem.

Plane electromagnetic wave: 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.

Transmission Lines: Transmission line equations and parameters, Input Impedance, Standing Wave Ratio, Smith Chart, Impedance matching, Distortion less line.

Recommended Books:

1. Matthew N.O. SADIKU : Elements of Electromagnetics
2. D. K. Cheng : Fields and Wave Electromagnetics
3. W.H.Hayt& J.A. Buck : Engineering Electromagnetics
4. A.B. Brownell and R.E. Beam : Theory and Application of Microwave.
5. J.D. Kraus : Antenna

EEE 3200: Engineering Project Design

Credits: 1.5, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Continuous Assessment: 40%, Exam: 50%]

General design aspect of electronic components: Filters, amplifier, oscillator audio amplifiers, power supply from both mains & batteries and other electronic circuit design. Typical design problems, digital circuit design. Electronic circuit design using op-amps, programmable timers, microcontrollers.

EEE 3240: Technical Seminar

Credits: 0.75, Contact Hours/ Week: 1.5

Marks: 100 [Attendance: 10%, Continuous Assessment: 40%, Exam: 50%]

Students will present two technical papers/topics related to electrical or electronics engineering in two seminars. The papers/topics must be selected from published renowned Journals or Conferences.

4th Year 1st Semester

EEE 4111: Communication Engineering II

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment and Presentation: 10%, Exam: 70%]

Motivation : To familiarize students with the prevailing communication systems of modern age.

Objectives : In this course student will learn about the digital communication system and Telecommunication networks. Students will also be briefly introduced with the radar and optical fiber communications.

I L O (Intended Learning Outcomes) : Successful completion of this course should enable students to-

i. Analyze and solve problems associated with telephony system and exchange system.

ii. Differentiate and compare different optical fiber communication.

iii. Explain the mechanism of different analog and digital switching system used in telecommunication networks.

iv. Comprehend the study of traffic engineering.

Course Contents

Telephony: Introduction to telephone system, principles, microphone, receiver and elements of telephone.

Ex-change: Introduction to switching systems, strowger and crossbar exchange, digital switching and exchange, signaling & switching technique, traffic theory, PABX system, telephone/exchange tariff measurement.

Optical communication*:* Optical fiber, characteristics, sources, detectors.

Introduction to satellite and RADAR communication.

Mobile communication: Introduction, concept, evolution and fundamentals, analog and digital cellular systems, cellular radio system, frequency reuse, cochannel interference, cell splitting, mobile radio propagation, propagation characteristics, models for radio propagation, antenna at cell site and mobile antenna, frequency management and channel assignment, different multiple access techniques, 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.

Introduction to networks: ISDN, B-ISDN, network topologies, LAN, MAN, WAN, BLUETOOTH, ATM, and multimedia communication, unicast, multicast, and broadcast.

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.

Access Network Technology: DSL, VDSL, HDSL, Fiber Access Network, FTTX.

Recommended Books:

1.	B. P. Lathi	:	Modern Digital and Analog Communication System
2.	Simon Haykin	:	Digital Communication Systems
3.	D. Roddy and J. Coolen	:	Electronic Communication
4.	T. Viswanathan	:	Telecommunication Switching Systems and Networks
5.	J. Martin	:	Communication Satellite System
6.	John Bellamy	:	Digital Telephony
7.	S.E. Miller and A.G. Chynoweth	:	Optical Fiber Communication
8.	Tri T Ha	:	Satellite Communications
9.	J.M. Senior	:	Optical Fiber Communication

EEE 4112: Communication Engineering II Sessional

Credits: 0.75, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Continuous Assessment: 40%, Exam: 50%]

Sessional based on theory course EEE 4111.

EEE 4121: Power System II

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment and Presentation: 10%, Exam: 70%]

Motivation : To familiarize students with the modern power system.

Objectives : Stability is a prime concern of any power system network which will be discussed through mathematical modelling in this course. Different attributes and challenges of AC and DC transmission will be studied. Mechanical aspects of transmission line will be studied.

I L O (Intended Learning Outcomes) : Successful completion of this course should enable students to-

i. Represent synchronous machines mathematically for stability studies.
ii. Compare and describe different aspects of AC and DC transmission and distribution system.
iii. Meet the challenges of quality power transmission.
iv. Encounter the mechanical challenges posed by the transmission line.
v. Comprehend the need for different insulator types.

Course Contents

Power System Stability: Definition and classification of stability, two axis model of synchronous machine, loading capability, rotor angle stability – swing equation, power-angle equation, synchronizing power coefficients, equal area criterion, multi-machine stability studies, step-by-step solution of the swing curve, factors affecting transient stability. Frequency and voltage stability.

Power Distribution: D.C and A. C distribution, calculation for different network configuration.

Flexible AC Transmission System (FACTS): Introduction, shunt compensation (SVC, STATCOM), series compensation (SSSC, TCSC, TCSR, TCPST), series-shunt compensation (UPFC).

Power Quality: Voltage sag and swell, surges, harmonics, flicker, grounding problems; IEEE/IEC standards, mitigation techniques.

Insulators and Transmission Lines: Design and constructional features of overhead power transmission lines and underground cables. Types of insulators and their coordination. Electric stress calculations and string efficiency. Insulator testing. Inductance and Capacitance of overhead power transmission line.

Mechanical Characteristics of Transmission Lines: Sag calculations and stress analysis.

Insulated Cable: Insulating materials, Electric stress grading of single phase and three phase cable. Dielectric losses and heating. Modern development, testing of insulated cables. Corona power loss. Kelvin's law. Economic conductor section, limitation and selection of ideal voltage.

Recommended Books:

1. William D. Stevenson Jr. : Elements of Power System Analysis
2. HadiSaadat : Power System Analysis
3. V.K. Mehta and Rohit Mehta : Principles of the Power System
4. Kothari and Nagrath : Power System Engineering
5. Ashfaq Husain : Electrical Power Systems
6. M. N. Bandyopadhyay : Electrical Power Systems: Theory and Practice
7. Arthur R. Bergen and Vijay Vittal : Power Systems Analysis

EEE 4122: Power System II Sessional

Credits: 0.75, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Continuous Assessment: 40%, Exam: 50%]

Sessional based on theory course EEE 4121.

EEE 4131: Digital Signal Processing

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment and Presentation: 10%, Exam: 70%]

Motivation : To introduce students the basic tools to deal with digital signals.

Objectives : In this course student will learn about Digital Signal Processing in regards to the common mathematical tools such as- impulse response, solution of difference equation, Z-transform, discrete time harmonic analysis, discrete Fourier transform. Students will also learn to design digital filters.

I L O (Intended Learning Outcomes) : Successful completion of this course should enable students to-

i. Comprehend the basics of digital signal processing.
ii. Find the impulse response of different discrete time systems.
iii. Find the Z transform and inverse transform of digital systems.
iv. Analyze and find the Fourier transform of discrete systems.
v. Apply the knowledge of previous tools in digital filter design.

Course Contents

Introduction to Digital Signal Processing (DSP): Signal, System and processing, Advantages and limitations of DSP, Components of DSP, Classification of Signals, Concept of Frequency, Sampling Theorem, Nyquist Rate, Aliasing, Quantization. Coding, Classifications of discrete time signal and systems, Implementation of discrete time systems, analog to digital conversion.

Impulse Response: Finite impulse response (FIR) and infinite impulse response (IIR) of discrete time systems Natural Response and Forced Response.

Solution of Difference Equation: Convolution, transient and steady state response.

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

Correlation: circular convolution, autocorrelation and cross correlation.

Discrete Time Harmonic Analysis: Discrete-time Fourier series, discrete-time Fourier transform & their Properties.

Discrete Fourier Transform: DFT definition and properties, Fast Fourier transform (FFT), inverse fast Fourier transform.

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.

Modern Filter: Ideal transfer function, general design procedure, Butterworth and Chebychev filters: approximation and design

Recommended Books:

1. J. G. Proakis and D.G. Manolakis : Digital Signal Processing: Principles, Algorithms and Applications
2. A.V. Oppenheim, R. W. Schafer and J.R. Buck : Discrete-Time Signal Processing
3. Dag Stranneby and William Walker : Digital Signal Processing And Applications

EEE 4132: Digital Signal Processing Sessional

Credits: 0.75, Contact Hours/ Week: 1.5

Marks: 100 [Attendance: 10%, Continuous Assessment: 40%, Exam: 50%]

Sessional based on theory course EEE 4131.

EEE 4141: Solid State Devices

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment and Presentation: 10%, Exam: 70%]

Motivation : To introduce students the basic knowledge about solid state devices.

Objectives : In this course student will gather depth knowledge about pn junction, BJT and MOS devices.

Course Contents

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 shortchannel effects in MOSFETs. MOS scaling.

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

Recommended Books:

1. Robert Boylestad and Louis Nashelsky : Electronic Devices and Circuits
2. S. O. Kasap Principles of Electronic Materials and Devices
3. Paul R. Gray, Paul J. Hurst, Stephen H. Lewis, and Robert G. Meyer : Analysis and Design of Analog Integrated Circuits
4. J. Millman and C.C. Halkias : Integrated Electronics
5. Introduction to Electronic Materials & Devices Prof. Sin-Doo Lee
6. Albert P. Malvino and David J. Bates : Electronic Principles
7. B. Grob : Basic Electronics
8. David A. Bell : Electronic Devices and Circuits

EEE 41XX: Elective I

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment and Presentation: 10%, Exam: 70%]

EEE 41XX: Sessional based on Elective I

Credits: 0.75, Contact Hours/ Week: 1.5

Marks: 100 [Attendance: 10%, Continuous Assessment: 40%, Exam: 50%]

Sessional based on theory course EEE 41XX.

EEE 4180: Thesis/ Project (Part-I)

Credit: 1.5, Contact Hours/ Week: 3

Marks: 50 [Internal Examiner: 30%, Presentation & Oral Exam: 70%]

Each student has to complete one project/ thesis in the combined duration of two semesters of fourth year. In 1st semester course EEE 4180, a student has to make a proposal defence at the end of the semester with 50% advancement of the total works. The defenced project/ thesis have to be completed in the continuation course EEE 4280 in 2nd semester of fourth year.

EEE 4190: Industrial Attachment

Credit: 0.75, Duration: 1-2 Weeks

Marks: 100 [Attendance: 10%, Continuous Assessment: 50%, Exam: 40%]

Students will take 1-2 weeks in-plant training in an "Electrical and Electronic Engineering" related industry or establishment. Student will be evaluated on the basis of a report submitted by them after the completion of the training, oral examination and the report from the concerned industry or establishment. This training is to be organized during the inter-semester break

4th Year 2nd Semester

EEE 42XX: Elective II

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment and Presentation: 10%, Exam: 70%].

EEE 42XX: Sessional based on Elective I

Credits: 0.75, Contact Hours/ Week: 1.5

Marks: 100 [Attendance: 10%, Continuous Assessment: 40%, Exam: 50%]

Sessional based on theory course EEE 42XX.

EEE 4221: Power System Protection and Switchgear

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment and Presentation: 10%, Exam: 70%]

Motivation **:** To teach students the necessary protective scheme of a power system.

Objectives **:** In this course student will be taught about 'Power System Protection' in regards to switchgear, fuse & relay, circuit breakers and breaker ratings; transformer, generator, motor, bus and transmission line protection; static, digital and numerical relay.

I L O (Intended Learning Outcomes) : Successful completion of this course should enable students to-

i. Understand the fundamentals of protective devices
ii. Distinguish between different type of relays and circuit breakers according to their construction and use
iii. Design protective scheme for transformer, generator, motor and transmission line
iv. Learn about digital and modern relays.

Corse Contents

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 it's 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, SF_6, 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, Buocholz 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. Sunil S. Rao : Switchgear protection and power systems
2. T. S. Madhava Rao : Power System Protection Static Relays
3. Badri Ram and D. Vishwakarma : Power System Protection and Switchgear
4. Paul M. Anderson : Power System Protection

EEE 4222: Power System Protection and Switchgear Sessional

Credits: 1.5, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Continuous Assessment: 40%, Exam: 50%]

Sessional based on theory course EEE 4221.

EEE 4231: VLSI Circuits and Design

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment and Presentation: 10%, Exam: 70%]

Motivation : The course is designed to give the students an understanding of the different design steps required to carry out a complete digital VLSI design in silicon.

Objectives : The objectives are to study both Circuits and System views together for design of VLSI system. It will offer a profound understanding of the design of complex digital VLSI circuits, computer aided simulation and synthesis tool for hardware design.

I L O (Intended Learning Outcomes) : Successful completion of this course should enable students to-

i. Be aware about the trends in semiconductor technology, and how it impacts scaling and performance.
ii. Learn Layout, Stick diagrams, Fabrication steps, Static and Switching characteristics of inverters
iii. Synthesize digital VLSI systems from register-transfer or higher level descriptions in hardware design languages.
iv. Understand MOS transistor as a switch and its capacitance
v. Design digital systems using MOS circuits.

Course Contents

IC trends, technology and design approaches.

MOS device: structure, operation, threshold voltage and characteristics.

Ratioed Circuits: NMOS inverter with resistive and transistor load, Pseudo NMOS inverter.

Ratioless Circuits: CMOS inverters: operation, transfer characteristics, design for equal rise and fall time, propagation delay, rise time, fall time and power consumption estimation. NMOS pass transistor and CMOS pass gate circuits. Buffer chain design to drive large capacitive load.

Integrated Circuit Fabrication Technology: Microelectronic technology, planner process, photolithography, BJT fabrication, FET fabrication, CMOS technology-CMOS process flow, design rules. Monolithic diodes, metal-semiconductor contact, IC resistor and capacitor, IC packaging, characteristics of IC components, microelectronic circuit layout, printed circuit board. Estimation of resistance and capacitance from layout. Layout matching. Stick diagram and area estimation from stick diagram. Reliability issues: Latch-up, electromigration.

Basic logic gates in CMOS. Synthesis of arbitrary combinational logic in CMOS, pseudo-NMOS, dynamic CMOS, clocked CMOS and CMOS domino logic. Structured design: Parity generator, bus arbitration logic, multiplexers-based design, programmable logic array (PLA) design, Field Programmable gate arrays (FPGA), I/O systems. Clocked sequential circuit design: two phase clocking, dynamic shift register. CMOS latches and flip flops. Introduction to VHDL hardware description language.

Subsystem Design: 4-bit arithmetic processor: bus architectures, shifter, design of a general purpose ALU.

Memory Elements Design: System timing consideration, three transistor and one transistor dynamic memory cell. Pseudo-static RAM/register cell. 4 transistors dynamic and 6 transistor static CMOS memory cell. 4x4 bit register array and 16-bit static CMOS memory array.

Finite State Machine Design: Design of Moore Type and Mealy type FSM using Verilog. Testing VLSI circuits.

Recommended Books:

1. Frank Vahid : Digital Design with RTL Design, VHDL and Verilog
2. Wayne Wolf : Modern VLSI Design: IP-based Design
3. Volnei A. Pedroni : Circuit Design and Simulation with VHDL

4. Neil Weste, David Harris : CMOS VLSI Design: A Circuits and Systems Perspective
5. John P. Uyemura Introduction to VLSI Circuits and Systems
6. Douglas A. Pucknell, Kamran Eshraghian Basic VLSI Design

EEE 4232: VLSI Circuits and Design Sessional

Credits: 1.5, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Continuous Assessment: 40%, Exam: 50%]

Sessional based on theory course EEE 4231.

EEE 42XX: Elective III

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment and Presentation: 10%, Exam: 70%].

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EEE 4280: Thesis/ Project (Part-II)

Credit: 3, Contact Hours/ Week: 6

Marks: 100 [Internal Examiner: 35%, External Examiner: 35%, Presentation & Oral Exam: 30%]

This course is a continuation of the course EEE 4180 from the 1st semester of fourth year. A student has to complete the proposed project/ thesis, submit it with review papers on topics by the end of the semester and make an oral defence of the project/ thesis.

EEE 4290: Board Viva-voce

Credit: 1

Marks: 100 [100% Viva-voce]

Board viva-voce will be conducted by Examination Committee based on the courses offered in fourth year.

List of Elective I Courses

EEE 4141: Renewable Energy

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment and Presentation: 10%, Exam: 70%]

Motivation : To introduce the sources of and needs for Renewable Energy.

Objectives : This course will undertake to introduce basic aspects of renewable energy supply presenting fundamental characteristics of the resource base (solar radiation, wind energy, geothermal, etc.) and principles of related technical systems (photovoltaic, wind, hydroelectric power generation, etc.). In a further step an economic and environmental analysis of supply technologies will be undertaken. Students will learn to acquire a basic understanding of
issues related to renewable energy supply systems.

I L O (Intended Learning Outcomes) : Successful completion of this course should enable students to-

i. Understand the fundamental characteristics of renewable energy sources and their differences compared to fossil fuels

ii. Understand the extent of environmental impact and resource depletion of each of the major non-renewable and renewable sources of energy

iii. Identify the challenges and problems associated with the use of various energy sources, including fossil fuels, with regard to future supply and the environment

iv. Be able to apply this knowledge to suggest the preferred combination of sustainable solutions/actions to minimize the emission of greenhouse gases and increase sustainability of the energy system in specific areas/regions.

Course Contents

Renewable Energy Sources: Solar, wind, mini-hydro, geothermal, biomass, wave and tides.

Solar Photovoltaic: Characteristics of photovoltaic (PV) systems, PV models and equivalent circuits, sun tracking systems,

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

Maximum Power Point Tracking (MPPT): Chopper, inverter. Sizing the PV panel and battery pack in stand-alone PV applications. Modern solar energy applications (residential, electric vehicle, naval, and space). Solar power plants connected to grid.

Solar Thermal: Principles of concentration, solar tower, parabolic dish, receiver, storage, steam turbine and generator.

Wind Turbines: Wind turbine types and their comparison, power limitation, Betz's law; Control mechanism: pitch, yaw, speed. Couplings between the turbine and the electric generator, Wind turbine generator - DC, synchronous, self-excited induction generator and doubly fed induction generator. Grid interconnection: active and reactive power control.

Biomass and biogas electricity generation.

Recommended Books:

1. D. Rapp : Solar Energy
2. M.J. Fish and H.C.W. Anderson : Introduction to Solar Technology
3. M.A. Green : Solar Cells
4. B.S. Magal : Solar Power Engineering
5. G.D. Rai Solar Energy Utiliztion
6. G.D. Rai Nonconventional Source of Energies

EEE 4142: Renewable Energy Sessional

Credits: 0.75, Contact Hours/ Week: 1.5

Marks: 100 [Attendance: 10%, Continuous Assessment: 40%, Exam: 50%]

Sessional based on theory course EEE 4141.

EEE 4151: High Voltage Engineering

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment and Presentation: 10%, Exam: 70%]

Motivation : To provide understanding of the engineering arena around that deals with high voltage.

Objectives : This course intends to develop and apply the theory of high voltage generation and measurements to the appropriate places. Students will also be taught of the breakdown of matters and how to test electrical equipment which is supposed to be exposed to high voltages.

I L O (Intended Learning Outcomes) : Successful completion of this course should enable students to-

i. Understand the principles of theory of high voltage generation and measurements
ii. Understand the operation of high voltage power supplies for ac, dc, and impulse voltages
iii. Get familiar with various applications where high voltage field is used.
iv. Understand breakdown of HV insulation (solid, Liquid and Gas).
v. Understand lightning phenomena and HV Insulation and Environmental pollution.

Course Contents

High Voltage DC Generation: Rectifier circuits, ripple minimization, voltage multipliers, Van-de-Graaf and electrostatic generators; applications.

High Voltage AC Generation: Tesla coils, cascaded transformers and resonance transformers.

Impulse Voltage Generation: Shapes, mathematical analysis, codes and standards, single and multi-stage impulse generators, tripping and control of impulse generators.

Breakdown in gas, liquid and solid dielectric materials, applications of gas and solid dielectrics in transformer. Corona.

High Voltage Measurements and Testing: IEC and IEEE standards, sphere gap, electrostatic voltmeter, potential divider, Schering bridge, Megaohm meter, HV current and voltage transducers: contact and noncontact.

Overvoltage Phenomenon and insulation coordination. Lightning and switching surges, basic insulation level (EV, EHV and UHV systems), surge diverters and arresters.

Recommended Books:

1. C. L. Wadhwa : High Voltage Engineering
2. M. S. Naiduand V Kamaraju : High Voltage Engineering
3. Ravindra Arora : High Voltage and Electrical Insulation Engineering

EEE 4152: High Voltage Engineering Sessional

Credits: 0.75, Contact Hours/ Week: 1.5

Marks: 100 [Attendance: 10%, Continuous Assessment: 40%, Exam: 50%]

Sessional based on theory course EEE 4151.

EEE 4161: Semiconductor Fabrication Technology

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment and Presentation: 10%, Exam: 70%]

Course Contents

Substrate materials: Crystal growth and wafer preparation, epitaxial growth technique, molecular beam epitaxy (MBE), chemical vapor phase epitaxy (CVPE), 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 metalization.

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.

EEE 4162: Semiconductor Fabrication Technology Sessional

Credits: 0.75, Contact Hours/ Week: 1.5

Marks: 100 [Attendance: 10%, Continuous Assessment: 40%, Exam: 50%]

Sessional based on theory course EEE 4161.

EEE 4171: Computer Networks

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment and Presentation: 10%, Exam: 70%]

Motivation : To learn the nature of communication among the machines.

Objectives : This course intends to build an understanding of the fundamental concepts of computer networking. Students will be familiarized with the basic taxonomy and terminology of the computer networking area. The students would supposed to gain expertise in some specific areas of networking such as the design and maintenance of individual networks.

I L O (Intended Learning Outcomes) : Successful completion of this course should enable students to-

i. Independently understand basic computer network technology
ii. Understand and explain Data Communications System and its components
iii. Identify the different types of network topologies and protocols
iv. Enumerate the layers of the OSI model and TCP/IP. Explain the function(s) of each layer.
v. Identify the different types of network devices and their functions within a network

Course Contents

Introduction: Computer networks, Types of computer networks, Network topology, Circuit switching and packet switching, Protocol and protocol hierarchies, The OSI reference model, TCP/IP protocol suit.

Physical Layer: The theoretical basis for data communication, Transmission media: Wired and wireless, Narrowband ISDN, Broadband ISDN and ATM.

Data link Layer: Data link layer design issues, Error detection and correction, Elementary data link protocols, Sliding window protocols, Protocol specification and verification, HDLC.

Medium Access Sublayer: Channel allocation problem, Multiple access protocols, IEEE standards for LANs and MANs, Bridges, and high-speed LANs, ATM and frame relay.

Network Layer: Network layer design issues, Routing algorithms, Congestion control algorithms, Internetworking, IP, IP addresses, Network layer protocols; ARP, IPv4, ICMP, IPv6, Routing protocols; OSPF and BGP.

Transport Layer: Process-to-process delivery, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), Congestion control and quality of service, Performance issues.

Application Layer: Client-server model, Domain Name System (DNS), Electronic mail (SMTP) and File Transfer Protocol (FTP), HTTP and WWW.

Recommended Books:

1. A. S. Tanenbaum : Computer Networks
2. Behrouz A. Forouzan : Data Communication and Networking
3. J.F. Kurose and K.W. Ross : Computer Networking
4. W. Stallings : Data and Computer Communication

EEE 4172: Computer Networks Sessional

Credits: 0.75, Contact Hours/ Week: 1.5

Marks: 100 [Attendance: 10%, Continuous Assessment: 40%, Exam: 50%]

Sessional based on theory course EEE 4171.

EEE 4181: Biomedical Engineering

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment and Presentation: 10%, Exam: 70%]

Motivation : Introduce students with the engineering measurement of human body for medical diagnosis and analysis.

Objectives : The course includes a revision of DC and AC circuit theory, hands-on practice in the use and testing of medical transducers and electromedical equipment in common use in hospitals and research laboratories to make measurements of biomedical variables of clinical significance. This course serves as an introduction to physiological measurement of bioelectric phenomena and neuro-stimulation.

I L O (Intended Learning Outcomes) : Successful completion of this course should enable students to-

i. Understand the physical principles which govern the measurement of a biological variable or system as an electrical quantity
ii. Get familiar with the basic medical instrumentation used clinically to perform these functions
iii. Get insight of bioelectric phenomena, bioelectrodes, medical electronics and neuro-stimulation.

Course Contents

Physics of Human Body: The cell, Body fluid, Musculo-skeletal system, Respiratory system, Nervous system, the circulatory system, the body as a control system, the heart, Bioelectricity, Work done by heart, blood pressure and its measurements, Membrane potentials, Electrical activity of excitable cells, Molecular basis of muscle contraction, Basic electrical signals from the muscles.

Interaction of Wave and Radiation with Human Body: Body's detector and matter wave, speech noise, physiological effects of intense matter waves, Interaction of electromagnetic radiation on living mater, penetration of rays into tissue. Biological effects of ionizing radiation: Dosimetry, primary effects, Biophysical effects of whole-body irradiation, radiation measurement and protection.

Biopotentials Electrodes and Amplifiers: Biopotential electrode, Sensors, Transducers and bioelectric amplifiers, Electromagnetic interference of medical electronic equipment, ENG, EMG, ECG, ERG, EEG, MEG.

Ultrasonography: Physics of ultrasonic wave, Ultrasonic transducers, Absorption and attenuation of ultrasound, Scan modes, scan pattern and scanning systems, Doppler imaging, Echocardiography, Ultrasonic flow meter, Ultrasonic blood pressure measurement.

X-ray: X-ray production, X-ray image formation and contrast, Contrast types, Effects of photon energy, Area contrast, Fluoroscopic imaging system, computed tomography.

Magnetic Resonance Imaging: Nuclear magnetic resonance, Image characteristics, Gamma camera.

Analytical and Medical Laboratory Instruments: Blood components, Colorimeter, spectrophotometer, Blood cell counter, pH/Blood gas analyzer, chromatograph, Auto analyzer, atomic absorption and atomic emission spectroscopy.

Therapeutic and Prosthetic Devices: Cardiac pacemaker, Hemodialysis, Defibrillator, Surgical diathermy.

Recommended Books:

1. C. J. Casey : Biophysics concept and mechanism
2. Joseph J Carr& John M Brown : Introduction to Biomedical equipment technology
3. John G Webster : Medical Instrumentation
4. Perry Sprawls : Physical principles of medical imaging
5. J. G. Skofronick : Medical Physics

EEE 4182: Biomedical Engineering Sessional

Credits: 0.75, Contact Hours/ Week: 1.5

Marks: 100 [Attendance: 10%, Continuous Assessment: 40%, Exam: 50%]

Sessional based on theory course EEE 4181.

EEE 4191: Embedded Systems

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment and Presentation: 10%, Exam: 70%]

Course Contents

Introduction: Embedded computing, characteristics of embedded computing applications, embedded-system design challenges, constraint-driven design, IP based design, hardware and software co-design. Development environment: Execution environment, memory organization, system space, code space, data space, unpopulated memory space, I/O space, system start-up, interrupt response cycle, function calls and stack frames, runtime environment, object placement.

Embedded computing platform: Sensors and actuators, embedded processors (CPUs), bus, memory devices, I/O devices, component interfacing, designing with microprocessors, development and debugging, design examples, design patterns, data-flow graphs, assembly and linking, basic compilation techniques, analysis and optimization. Real time embedded systems, real time operating systems, embedded systems programming, mapping between languages and hardware, embedded communication systems, and embedded computer security.

Distributed embedded-system design: Inter-process communication, shared memory communication, accelerated design, design for video accelerators, networks for embedded systems, network-based design, internet-enabled systems.

Design techniques: Design methodologies and tools, design flows, designing hardware and software components, requirement analysis and specification, system analysis and architecture design, system integration, structural and behavioral description, case studies.

EEE 4192: Embedded Systems Sessional

Credits: 0.75, Contact Hours/ Week: 1.5

Marks: 100 [Attendance: 10%, Continuous Assessment: 40%, Exam: 50%]

Sessional based on theory course EEE 4191.

List of Elective II Courses

EEE 4201: High Voltage DC and Flexible AC Transmission

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment and Presentation: 10%, Exam: 70%]

Course Contents

Classic HVDC transmission (LCC HVDC) for the bulk power transmission over long distances, Introduction, operation and control of VSC-HVDC transmission for the connection of relatively weak grids, and grid connection of renewable energy sources, Introduction, operation and control evolution of modular multi-level converters and MMC-HVDC-Introduction, operation and control power converters and FACTS devices: Applications to reactive power compensation and power oscillation damping. Shunt compensating devices SVC, STATCOM; Introduction, operation and control. Study of PSCAD-EMTDC, DigSILENT, real time digital simulation (RTDS) and other advanced simulation tools for HVDC.

EEE 4202: High Voltage DC and Flexible AC Transmission Sessional

Credits: 0.75, Contact Hours/ Week: 1.5

Marks: 100 [Attendance: 10%, Continuous Assessment: 40%, Exam: 50%]

Sessional based on theory course EEE 4201.

EEE 4203: Special Machines and AC Drives

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment and Presentation: 10%, Exam: 70%]

Course Contents

Special machines: Construction, characteristics and application of universal motor, hysteresis and stepper motors, electrostatic motor, repulsion motor, brushless DC motor, switched reluctance motors, linear induction motors, servomotors, rotating power amplifiers, permanent magnet motors: IPMSM motors and SPMSM, stepper motors.

Electro mechanical energy conversion: Principles of electro-mechanical energy conversion, energy balance, energy in multiple excited magnetic systems, mechanical force and co-energy.

Industrial drives: Closed loop scalar control of induction motor, slip power recovery, constant slip, flux and torque control, direct and indirect vector control of induction motor, synchronous motor drives, PM synchronous motor drives, BLDC motor drives, stepper motor controller.

EEE 4204: Special Machines and AC Drives Sessional

Credits: 0.75, Contact Hours/ Week: 1.5

Marks: 100 [Attendance: 10%, Continuous Assessment: 40%, Exam: 50%]

Sessional based on theory course EEE 4203.

EEE 4205: Nuclear Power Engineering

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment and Presentation: 10%, Exam: 70%]

Course Contents

Basic concepts: nuclear energy, atoms and nuclei, radioactivity, nuclear processes, fission, fusion. Nuclear systems: particle accelerator, isotope separators, neutron chain reaction, reactor types,power generation. Layout of nuclear power plant (NPP). Nuclear power plant reactors: pressurized water reactor, boiling water reactor, CANDU reactor, gas cooled reactor, liquid metal cooled reactor, breeder reactor. Auxiliaries, instrumentation and control. Grid interconnection issues: effects of frequency and voltage changes on NPP operation. Advanced and next generation nuclear plants; very high temperature reactors. Biological effects, reactor safety and security; Three Mile Island case; Chernobyl case; Fukushima case. Fuel cycle; radioactive waste disposal.

EEE 4206: Nuclear Power Engineering Sessional

Credits: 0.75, Contact Hours/ Week: 1.5

Marks: 100 [Attendance: 10%, Continuous Assessment: 40%, Exam: 50%]

Sessional based on theory course EEE 4205.

EEE 4207: Optoelectronics

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment and Presentation: 10%, Exam: 70%]

Motivation : To present an introduction of optoelectronic devices.

Objectives : This course is designed for understanding basic laws and phenomena in the area of Optoelectronics and Lasers. Students will be introduced with theoretical preparation to acquire and apply knowledge and skills in Optoelectronic devices.

I L O (Intended Learning Outcomes) : Successful completion of this course should enable students to-

i. Explain fundamental physical and technical base of Optoelectronic systems
ii. Describe basic laws and phenomena that define behavior of optoelectronic systems
iii. Analyze various premises, approaches procedures and results related to optoelectronic systems
iv. Describe development and application of optoelectronic systems.

Course Contents

Optical Properties in Semiconductor: Direct and indirect band-gap materials, basic transitions in semiconductors, radiative and nonradiative 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. Double-Hetero-structure (DH) LEDs, Characteristics, Surface and Edge emitting LEDs.

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, elementary laser diode characteristics, heterojunction lasers, optical and electrical confinement. Single frequency solid state lasers-distributed Bragg reflector (DBR), distributed feedback (DFB) laser.

Introduction to Quantum Well Lasers. Introduction to quantum well lasers, Vertical Cavity Surface Emitting Lasers (VCSELs), optical laser amplifiers.

Photo-detectors: Photoconductors, junction photo-detectors, PIN detectors, avalanche photodiodes, hetero-junction photodiodes, Schottky photo-diodes and phototransistors. Noise in photodetectors. PIN and APD. Photo-detector design issues.

Modulation of Light: Phase and amplitude modulation, electro-optic effect, acousto-optic effect and magneto-optic devices. Introduction to integrated optics.

Recommended Books:

1. Wilson and Hawkes : Optoelectronics: An Introduction
2. J. Wilson, J.F.B. Hawkes : Optoelectronics
3. Michael A. Parker : Physics of Optoelectronics
4. Pallab Bhattacharya : Semiconductor Optoelectronic Devices
5. S.C. Gupta Optoelectronic Devices and Systems
6. Joachim Piprek Optoelectronic Devices

EEE 4208: Optoelectronics Sessional

Credits: 0.75, Contact Hours/ Week: 1.5

Marks: 100 [Attendance: 10%, Continuous Assessment: 40%, Exam: 50%]

Sessional based on theory course EEE 4207.

EEE 4209: Analog Integrated Circuits

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment and Presentation: 10%, Exam: 70%]

Course Contents

Analog IC Design: Bipolar, MOS and BiCMOS IC technology and its impact, eggshell analogy, application areas and the future of analog IC design. Review of transistors: large and small signal models, compact. Models for Bipolar, FET, and BiCMOS. Amplifiers with passive and active loads, cascode

stages. Multiple current sources/sinks using Bipolar and FET technologies. Current mirrors: Basic, cascode and active current mirrors; influence of channel modulation, mismatched transistors and error in aspect ratios. Wilson current mirror. Constant current or voltage references: Supply voltage and temperature independent biasing, band-gap references; constant-Gm biasing. Widlar band-gap voltage reference. Differential pairs: Differential vs. single-ended operations of simple amplifiers, differential and common mode voltages, common mode rejection ratio (CMRR), and input common mode range (ICMR), transfer characteristics, small signal analysis, and frequency response of differential pairs.

High-gain amplifiers: Design and analysis of operational amplifiers (Op Amps) using BJTs and FETs, hierarchy in analog integrated circuits for an Op-Amp, internal structure of IC Op-Amps, high performance Op-Amps. Switch capacitor circuits: Equivalent resistance of a switched capacitor, unity gain buffers, charge amplifiers and integrators. Sampling switches: Charge injection, clock feed-through, charge feed-through; quantized model and remedy of charge injection. Switched capacitor filters. Origin of internally developed noises in ICs; shot, thermal, flicker, burst and avalanche noises in a device. Representation of noises in circuits, noises in single stage and differential amplifiers, noise bandwidth.

EEE 4210: Analog Integrated Circuits Sessional

Credits: 0.75, Contact Hours/ Week: 1.5

Marks: 100 [Attendance: 10%, Continuous Assessment: 40%, Exam: 50%]

Sessional based on theory course EEE 4209.

EEE 4213: Microwave Engineering

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment and Presentation: 10%, Exam: 70%]

Motivation : This course will introduce the use and applications of microwave devices.

Objectives : This course intends to give idea about the basic principles, fundamental of microwave technology, general formulation, modes of propagation and losses in parallel plate, rectangular and circular waveguides.

I L O (Intended Learning Outcomes) : Successful completion of this course should enable students to-

i. Describe the basic principle of microwave technology
ii. Basic element of microstrips, its structures and characteristics
iii. Describe principle of operation, application and uses of different microwave devices

Course Contents

Transmission Lines: Transmission line equations and parameters; Transmission line configuration and formulae, Transmission line at radio and audio frequency.

Impedance Matching: Line termination, Smith chart, S. W. R. Q and band width, Balanced and unbalanced feeder from transmitter to antenna, Distortion-less line.

Waveguides: Rectangular and cylindrical wave guides, Cavity resonators, Microstrip lines and their characteristics.

Microwave Components: Microwave hybrid circuits, scattering parameters, Wave guide Tees, Directional couplers, Circulators and Isolators, Phase shifter and attenuator.

Solid State Microwave Devices: Gunn diode, IMPATT Diode, TRAPATI Diode.

Microwave Tubes: Klystron, Magnetron, TWT.

Microwave Antenna: Hertzian and half wave dipoles. Mono pole, horn, rhombic and parabolic reflector, array, and Yagi-Uda antenna.

Microwave Link: Microwave link and its advantage, Frequency assignment and modulation methods, Transmitting and receiving equipment, Base band repeater, IF repeater, Microwave carrier supply, Auxiliary channels.

Recommended Books:

1. D M Pozar : Microwave Engineering
2. Thomas G Lavevghetta : Microwave Measurements and Technique
3. D. Roddy and Coolen : Electrical Communication
4. S. Gupta : Microwave Engineering
5. Y. Liao : Microwave Devices and Circuits

EEE 4214: Microwave Engineering Sessional

Credits: 0.75, Contact Hours/ Week: 1.5

Marks: 100 [Attendance: 10%, Continuous Assessment: 40%, Exam: 50%]

Sessional based on theory course EEE 4213.

EEE 4215: Telecommunications Engineering

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment and Presentation: 10%, Exam: 70%]

Course Contents

Introduction: Principle, evolution and telecommunication networks. National and International regulatory bodies, Telephone apparatus, telephone Exchanges, subscriber loop, supervisory tones, PSTN. Switching systems: Introduction to analog system: Strowger and Crossbar switching systems, Stored program control (SPC) systems, Digital switching systems: space division switching, time division switching, blocking probability and multistage switching, and digital memory switch. Traffic analysis: Traffic characterization, grades of service, network blocking probabilities, delay system and queuing. Integrated services digital network (ISDN): N-ISDN and B-ISDN, architecture of ISDN, B-ISDN implementation. Digital subscriber loop (DSL), Wireless local loop (WLL), FTTx, SONET/SDH, WDM Network, IP telephony and VoIP, ATM network and Next Generation Network (NGN).

EEE 4216: Telecommunications Engineering Sessional

Credits: 0.75, Contact Hours/ Week: 1.5

Marks: 100 [Attendance: 10%, Continuous Assessment: 40%, Exam: 50%]

Sessional based on theory course EEE 4215.

EEE 4219: Wireless Communications

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment and Presentation: 10%, Exam: 70%]

Course Contents

Introduction: Wireless communication systems, regulatory bodies. Radio wave propagation: Free-space and multi-path propagation, ray tracing models, empirical path loss models, large-scale and smallscale fading, power delay profile, Doppler and delay spread, coherence time and bandwidth. Statistical channel models: Time varying channel models, narrowband and wideband fading models, baseband equivalent model, discrete-time model, space-time model, auto- and cross-correlation, PSD, envelope and power

distributions, scattering function. Channel capacity: Flat-fading channels - CSI, capacity with known/partially known/unknown CSI. Frequency selective fading channels - time-invariant channels, time-varying channels. Performance of digital modulations: Error and outage probability, inter-symbol interference, MPSK, MPAM, MQAM, CPFSK. Diversity techniques: Time diversity - repetition coding, beyond repetition coding. Antenna diversity - SC, MRC, EGC, spacetime coding. Frequency diversity - fundamentals, single-carrier with ISI equalization, DSSS, OFDM. Space-time communications: Multiantenna techniques, MIMO channel capacity and diversity gain, STBC, OSTBC, QOSTBC, SM, BLAST, smart antennas, frequency selective MIMO channels. Broadband communications: DSSS, FHSS, spreading codes, RAKE receivers, MC-CDMA, OFDM, OFDMA, multiuser detection, LTE, WiMAX.

EEE 4220: Wireless Communications Sessional

Credits: 0.75, Contact Hours/ Week: 1.5

Marks: 100 [Attendance: 10%, Continuous Assessment: 40%, Exam: 50%]

Sessional based on theory course EEE 4219.

EEE 4223: Digital Image Processing

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment and Presentation: 10%, Exam: 70%]

Course Contents

Basic image processing system: Image sources, characteristics, image representation, hardware and software requirements.

Two dimensional systems: Properties of two-dimensional sequence and systems, 2D Fourier transform, 2D Z-transform, 2D sampling theory. Image quantization, image perception, quality measures. Arithmetic and statistical image processing techniques.

Image transform: 2D DFT, 2D DCT, sine transform, Hadamard, slant and KL transform.

Image compression algorithms: Pixel coding-PCM, run length coding, predictive technique DPCM, transform coding-DCT, vector quantization, VQ in image coding, wavelet-based compression, intra-frame coding, standard for image compression-JPEG, MPEG.

Image segmentation: Feature extraction, edge detection, boundary extraction, region representation, moment representation, shape feature, scene matching, image segmentation, classification techniques of super supervised and non-supervised learning.

EEE 4224: Digital Image Processing Sessional

Credits: 0.75, Contact Hours/ Week: 1.5

Marks: 100 [Attendance: 10%, Continuous Assessment: 40%, Exam: 50%]

Sessional based on theory course EEE 4223.

List of Elective III Courses

EEE 4225: Power System Operation and Control

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment and Presentation: 10%, Exam: 70%]

Course Contents

Modeling of power system, load modeling, generation system, micro-grid and smart grid structure, distributed generation system. Principles of power system operation: Power system sensing, communication and control techniques, SCADA, conventional and competitive environment. Unit commitment, predictive load estimation and management. State estimation, static security analysis, optimal power flow analysis, automatic generation control and dynamic security analysis. Fundamental concepts and approaches in multi-agent systems for next generation power systems.

EEE 4227: Smart Grid

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment and Presentation: 10%, Exam: 70%]

Course Contents

Smart grid: two-way communication; distributed energy resources (DERs) - DG (distributed generation) and ES (energy storage); high power density batteries, EV (electric vehicles) and PHEV (plug-in hybrid electric vehicles); smart sensors, meters and appliances at demand side. Data communication channels; protocols; TCP/IP; IEEE 802 series wireless LANs: bluetooth, Zigbee, WiMax; wired LANs- Ethernet, PSTN, PLC (Power Line Carrier); cyber security. Smart meters and AMI (advanced metering infrastructure): construction; standards for information exchange- Modbus, DNP3 and IEC61850; interfacing with HAN, NAN, WAN. Power electronic interfaces between grid and DERs. Demand side integration (DSI): DSM; real time pricing; ancillary markets; DR (demand response) for load shaping, frequency and voltage control, energy efficiency. Microgrids, self-healing and restoration.

EEE 4229: Semiconductor Device Theory

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment and Presentation: 10%, Exam: 70%]

Course Contents

Electronic band structure, dispersion relation, tight binding model.

Lattice vibration: Simple harmonic model, phonon dispersion relation, acoustic and optical phonons. Scattering theory: Fermi-golden rule, scattering rates of different processes, scattering mechanisms in different semiconductors, mobility.

Different carrier transport models: Drift-diffusion theory, Boltzman transport equations, ballistic transport, Landauer- Buttiker approach, quantum mechanical model.

MOS devices: Band diagram and electrostatics of single gate, double gate, SOI and Fin FET. Carrier transport, I-V and C-V characteristics.

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

(HBT): Band bending, carrier transport, Gummel-Poon model.

EEE 4233: Introduction to Nanotechnology and Nanoelectronics

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment and Presentation: 10%, Exam: 70%]

Course Contents

Why Nanotechnology: importance, size scales, quantum size effects, revolutionary applications, potentials. Nanotools: scanning tunneling microscope, atomic force microscope, electron microscope, measurement techniques based on fluorescence, other techniques. Basics of Fabrication: fabrication and processing industry, wafer manufacturing, deposition techniques: evaporation, sputtering, chemical vapor deposition, epitaxy; Wet and dry etching techniques; photolithography, electron beam lithography, stamp technology. Bottom-up processes: chemical and organic synthesis techniques, self-assembly, other techniques. Nanoelectronics: overview of quantum mechanics, Schrodinger equation, particle in a box. Band theory of solids. Importance of nanoelectronics, Moore‟s law, ITRS roadmap. Tunneling devices: quantum tunneling, resonant tunneling diodes. Single electron transistor: Coulomb blockade. Quantum confinement: wires and dots, carbon nanotubes, graphenes. Brief introductions on Molecular electronics and nanobiology.

EEE 4237: Telecommunication Networks

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment and Presentation: 10%, Exam: 70%]

Course Contents

Introduction Telecom System and Networks, Essentials of a Telecom Network. Telecommunication Switching system: TDM switching, Space division switching, Time-Space Switching, Circuit Switching and Packet Switching, Switching Fabrics. Integrated Services Digital Network (ISDN), Broadband ISDN (B -ISDN), Switching and Signaling Techniques in ISDN, Signaling System–7 (SS-7), ISDN Protocols and standards. Telecom Network Architectures, Network Topology: Ring, Bus, Tree, Star, Architecture of a node, Functions of a node; Routing & Switching, Principles of Routing; Hot Potato Routing, Deflection Routing, Virtual Path Routing, Shortest Path Routing etc. Access Technologies: Conflict free Multiple Access techniques: FDMA, OFDMA, TDMA, CDMA, Demand Assignment Multiple Access (DAMA), CSMA-CD, CSMA-CA. Network Protocol Stack, IP Protocol, Voice over IP (VoIP), Asynchronous Transfer Mode (ATM) technology, IP over ATM, Synchronous Optical Network (SONET) and Synchronous digital Hierarchy (SDH), IP over SONET, SONET over WDM networking Access Network Technologies: Hybrid Fiber Coax (HFC), Fiber to the X (FTTX), Ethernet Passive Optical Network (EPON), Gigabit PON (GPON). Next generation Networking (NGN), Next generation SONET/SDH, Networks and Standards, Multiple Protocol Label Switching (MPLS), MPLS over WDM.

EEE 4239: Radar and Satellite Communications

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment and Presentation: 10%, Exam: 70%]

Course Contents

Introduction to Satellite Communication, Satellite frequency bands, satellite orbits, satellite types, regulation of the spectrum and interference, propagation channel, air interfaces, link budget analysis, Digital Modulation, Error Correction Codes, Multiple Access, receiver synchronization, baseband processing, fixed and mobile applications, basics of satellite networking. Radar equation, radar cross section, information contents in radar signals, noise and clutter, radar detectors, Doppler and MTI radar,

pulse compression, CW and FM-CW radar, radar transmitter and receivers, introduction to polarimetric radar and synthetic aperture radar.

EEE 4243: Wireless and Mobile Networks

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment and Presentation: 10%, Exam: 70%]

Course Contents

Overview of wireless networks, different generations of wireless networks. Wireless Transmission techniques: baseband transmission, Carrier modulated band pass transmission, Ultra wideband (UWB) transmission, wireless modems, Spread Spectrum techniques; direct system (DS) and Frequency Hopping (FH) Spread Spectrum Systems. Wireless Network topologies, Cellular networks, Cellular fundamentals, carrier to co channel interference ratio (C/CCI), Capacity expansion techniques. Access Techniques: FDMA, TDMA, CDMA, narrowband and wideband Access technologies, OFDMA, Hybrid multiple Access techniques: FDMA-TDMA, OFDMATDMA, MC-CDMA; Spectral Efficiency and Capacity of wireless networks. Diversity in Mobile networks: MIMO Wireless Networks, Space, Time and Frequency coding techniques. Switching technologies: Circuit switching, packet switching, Protocol Stack, Random Access Technology and Wireless LANs, Aloha, Slotted Aloha, CSMA-CA and W-LAN Protocols, Routing in Wireless Networks, Optimal Routing and Scheduling, Single-hop and Multihop Networks. Quality of Service (QoS) in Wireless Networks, Traffic Management, Wireless Adhoc Networks, Wireless Sensor Networks. Cellular Network standards: GSM, IS-95, UMTS, CDMA- 2000, W-CDMA, 3G and future generation.

EEE 4245: Fuzzy Neuro Systems and Artificial Intelligence

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment and Presentation: 10%, Exam: 70%]

Course Contents

Introduction: Definition of AI, historical development of AI, applications of AI, AI techniques, logic: prepositional logic, first-order logic, resolution principle, problem representation: state-space representation, problem reduction representation, production systems: PS structure, recognition-action cycle, inference directions, blackboard systems, PS implementation. Frame representation: Basic structure, inheritance of properties, slot extension implementation. Relational data model: Relational database model, entity and relationship generalization and aggregation. Search: blind and non-blind searches, depth-first search, breadth-first search, heuristic search, best-first search, optimal search, a search implementation complexity. Fuzzy knowledge: Probability theory, Dempster-Shafer theory, fuzzy set theory, expert systems, natural language processing: Syntactic semantics and pragmatic, top-down pursing, bottom-up pursing, lexicon, programming languages for AI research: Historical overview, features of AI programming languages, major AI programming languages lisp & prolog, artificial neural networks, training, modeling estimation with ANN.

EEE 4247: Introduction to Medical Imaging

Credits: 3, Contact Hours/ Week: 3

Marks: 100 [Attendance: 10%, Class Test: 10%, Assignment and Presentation: 10%, Exam: 70%]

Course Contents

Introduction to imaging, medical imaging modalities, Medical imaging before x-rays, Hippocratic thermography, dissection, laproscopy, X-radiography, Computed tomography (CT), evolution of CT scanner design, image reconstruction algorithms, filtered back projection method, iterative method, low dose computed tomography, Ultrasound, Sonar and other early applications of acoustics, basic principles of ultrasound imaging, Evolution of ultrasound technology and clinical applications, Magnetic resonance imaging, Early use of nuclear magnetic resonance (NMR) spectroscopy, Principles of NMR and MRI, Evolution of magnetic resonance imaging (MRI) technology and clinical applications, development and applications of functional MRI, Introduction to Nuclear imaging.