AUST

Department of
Electrical and Electronic Engineering

Calendar
2013

Ahsanullah University of Science & Technology

AHSANULLAH UNIVERSITY OF SCIENCE AND TECHNOLOGY
Published in January 2014

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DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

CALENDAR 2013

JANUARY 2014

Disclaimer

The information contained in this bulletin is intended to provide guidance to those who are concerned with undergraduate studies in Electrical and Electronic Engineering. No responsibility will be borne by the Department of Electrical and Electronic Engineering and/or the Ahsanullah University of Science and Technology if any inconvenience or expenditure is caused to any person because of the information in this bulletin. Also the information contained in it is subject to change at any time without any prior notification.

Preface to Calendar 2013

The review of the calendar 2007 has been taken in hand with a view to update and incorporates elements of emerging and frontier technologies keeping in view to the syllabus of the Department of Electrical and Electronic Engineering (EEE), Bangladesh University of Engineering and Technology (BUET) and some foreign countries. Since the establishment of the university in 1995, the course structure and course contents are being thoroughly reviewed and updated from time to time by an expert committee to introduce dynamism in curricula in order to ensure education of international standard. It is hoped that the new Bulletin 2013 would provide an insight to the long regular academic courses to help develop human resources of the country in the fields of Electrical, Electronics and Communication Engineering.

Head
Department of Electrical and Electronic Engineering
Ahsanullah University of Science and Technology

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Chapter 1   General Information

The Department of Electrical and Electronic Engineering of Ahsanullah University of Science and Technology (AUST) is offering a four-year undergraduate degree program since the establishment of AUST in the year 1995. The degree program is spread over eight semesters with two semesters per academic year. The present intake of the students per calendar year is 350 students in seven sections, each of 50 students. The class size has been limited to 50 students in the interest of effective teaching. There are now about 1400 students studying in the department. Twenty one batches of students have graduated and are employed in different technical organizations in home and abroad.

There are now 51 full time teachers of the department together with 2 senior part time teachers from Bangladesh University of Engineering and Technology (BUET).

The aim of engineering education is to impart to the students up-to-date theoretical and practical knowledge of the particular branch of engineering. Consequently the undergraduate courses offered to the students have been designed considering the courses offered in BUET and some foreign universities, keeping in view the ever-increasing horizon of Electrical and Electronic Engineering. It may be mentioned here that a number of students of EEE Department of AUST got transferred to US Universities with credit transfer of courses taken at AUST. Many graduates are pursuing higher studies in the USA, Canada, the UK, Germany, Finland, Australia, Singapore etc.

The department has already developed its own laboratories in such areas as Electrical Circuits, Electronics, Digital Electronics, Electrical Machines, Telecommunications, Control Systems, Switchgear and Protection, Power Systems, Microwave Engineering, Microprocessors, VLSI Design and Digital Signal Processing.

The department favors interaction between University and industry and, in this connection, some of the activities of the department are:

- Education tour of students to industry, power stations and telecommunication centers etc.
- Seminars: Resource persons are invited to speak on selected topics of interest.
- Project display of final year students.
- Job Fair: Prospective employers are invited to speak on job opportunities in their organizations.

Chapter 2   Academic Information

2.1   Admission

There are two semesters in every year (Spring and Fall). Admission for 1st year, 1st semester is open in every semester. Notice for admission in Bachelor Degree Programs is published in local dailies.

2.2   Working weeks of a semester

The semester is of 20 working weeks which may be divided into classes, preparatory leave and semester final examinations as follows:

Classes	15	weeks
Preparatory leave and semester final examination	5	weeks
Total	**20**	**weeks**

Apart from the 20 working weeks, the University remains open for clearance/improvement/carryover examinations, result, admission of students in the 1st semester of 1st year and for works related to industrial training etc.

2.3   Medium of Instruction

The medium of instruction in Bachelor Degree programs is English and as such proficiency in English is a prerequisite for the candidates to get admission in the degree programs.

2.4   Examinations, Grading System and GPA Requirements for Bachelor Degree Programs

The performance of a student in a theoretical course will be based on:

(i) Continuous assessment (attendance, class performance, quizes and/or assignments etc.).

(ii) Semester final examination.

(iii) Clearance examination (for clearance of the course(s) not passed in the current semester or in the previous semester(s), if any)

(iv) Improvement examination, if any.

The performance of a student in a sessional/practical subject will be based on attendance, class performance, quizzes, assignment, viva, reports, practical examination etc.

The continuous assessment and the semester final examination will form regular examination system while the clearance examination and the improvement examination will provide additional opportunities to the students.

The distribution of marks of the continuous assessment and the semester final examination will be as follows:

i.	Class participation (i.e. attendance, class performance etc.)	10%
ii.	Quizzes and/or assignments	20%
iii.	Semester final examination	70%
	Total	**100%**

The number of quizzes and/or assignments in a course of study shall ordinarily be $n + 1$, where n is the number of credits of the course. Evaluation of the performance will be on the basis of the best n quizzes and/or assignments.

Clearance examination in a course will be held only for those students obtaining a grade 'F' (failed the course) in the course in regular examinations. Clearance examinations will be held over a period of 1 to 2 weeks at the end of each semester final examination.

Clearance examination in a course will carry 70% of the total marks assigned to the course, the rest 30% will be entered from the record of continuous assessment secured earlier by the student when he/she attended the classes. Whatever is the total mark, the maximum attainable grade in the clearance examination is 'C'.

A student obtaining 'F' grade in a maximum of 2 (two) theoretical courses in any semester will also be promoted to the next higher semester with carry over in the failed theory courses provided that he/she has passed in the rest of the theoretical and practical/sessional courses of the semester. But the maximum allowable cumulative number of such carryover courses of the present and the previous semester(s) of the student concerned for promotion is 4 (four). The students can clear the backlog of the carry over course(s) in the clearance examinations of the relevant semester of the successive batches. The examination & grading of the carry over examinations will be in the same manner as clearance examination.

If the number of carry over courses of a student exceeds the allowable limit, the student will not be promoted to the subsequent semester. The student can proceed to the next higher semester only after reducing the number within the allowable limit. Meanwhile, he/she can appear in the relevant carry over examination with a view to clear the backlog of the carry over course(s) of the previous semester(s). For appearing in the carry over examinations, the students are required to apply for enrollment within due time in the prescribed form available in the examination section of the University.

A student can re-register by a written application in the course(s) (both theoretical & practical) of the previous semester he/she failed. The student may also be allowed on a written application to re-register for any or all course(s) of the semester in which he/she secured any passing grade(s) in the course(s). However, the grade(s) in the re-registered course(s) will be considered for result and Grade Point Average (G.P.A.) and the previous grade(s) will be recorded in the transcript/grade card only for chronological sequence. The students are required to apply in the prescribed application form available in the office of the Registrar for re-registration. The application form duly filled in will be submitted to the office within 2 weeks of the commencement of the classes.

For the purpose of grade improvement, a student obtaining a grade lower than 'B' in a course can sit in the relevant Improvement examination by canceling his/her earlier passing

grade of the course. The improvement examination in a course will carry 70% of the total mark assigned to the course and like the clearance examination the rest of the mark will be entered from the record of the continuous assessment secured earlier by the student. Whatever is the total mark of the improvement examination, a student will be allowed to earn at best a grade 'B' for the course and the previous grade will be recorded in the transcript/grade card only for chronological sequence. Whatsoever, a student in a 4-year degree program can try to improve his/her grades in a maximum of 4 (four) courses while a student of Architecture who goes through a 5-year program can do the same in a maximum of 5 (five) courses in his student career in the AUST.

All 4-year degree programs at the AUST will require completion of all degree requirements within a maximum period of 7 academic years. The 5-year bachelor degree program of Architecture will require completion of all degree requirements within a maximum period of 8 academic years. Failure to complete all degree requirements within the given time frame may disqualify a student from continuation of his study at the AUST.

Letter grades and the corresponding grade-points will be awarded in accordance with the provision shown below:

Letter	% of Marks	Credit points
A+	80% or above	4.00
A	75% to less than 80%	3.75
A-	70% to less than 75%	3.50
B+	65% to less than 70%	3.25
B	60% to less than 65%	3.00
B-	55% to less than 60%	2.75
C+	50% to less than 55%	2.50
C	45% to less than 50%	2.25
D	40% to less than 45%	2.00
F	Less than 40%	0 (FAIL)
E	Exempted	-
W	Withheld	-

2.5   GPA / CGPA Calculation

$$GPA = \frac{Sum\ of\ [Product\ of\ Weightage \times Credit]}{Total\ Credit}$$

There are 5 theoretical and 4 laboratory courses in the first semester for EEE students. Let a student earns following grades for his first semester courses:

Course	Grade	Weightage for grades	Credit	Total Point
EEE 1101	A+	4.00	3.0	4.00 × 3 =12
EEE 1102	A-	3.50	1.5	3.50 ×1.5 = 5.25
ME 1101	A	3.75	3.0	3.75 ×3 = 11.25
ME 1102	D	2.00	1.5	2.00 ×1.5 = 3.00
PHY 1105	B+	3.25	3.0	3.25 ×3 = 9.75
PHY 1106	A	3.75	1.5	3.75 ×1.5 = 5.625
MATH 1103	B-	2.75	3.0	2.75 ×3 = 8.25
CHEM 1107	B	3.00	3.0	3.00 ×3 = 9.00
CHEM 1108	C+	2.50	1.5	2.50 ×1.5 = 3.75
Total Point Earned				**67.875**

$$Then,\ his\ GPA\ for\ the\ first\ semester = \frac{Total\ point\ earned}{Total\ Credit}$$

$$= \frac{67.875}{21} = 3.23 \text{ on a scale of 4.}$$

CGPA stands for Cumulative GPA. If a student, after second year (after 4 semesters) earns the following points:

Semester	Credit	Points earned
I	21	67.875
II	19.5	75.125
III	21	80
IV	21	78
Total Credit = 82.5		**Total Point = 301**

Then CGPA of that student = (301/82.5) = 3.65 on a scale of 4.

Students will be considered to be making normal progress towards a degree if their cumulative or overall GPA for all works attempted is not less than 2.20. Students who fail to maintain this minimum rate of progress may be placed on academic probation. A minimum Cumulative GPA (CGPA) of 2.20 on a scale of 4 will be required for the award of the Degree.

The status of academic probation is a reminder/warning to the student that satisfactory progress towards graduation is not being made. The minimum period of probation is one semester but the usual period is one academic year. The probation may be extended for additional semesters until the student achieves an overall GPA of 2.20 or better.

A student on academic probation who fails to maintain at least a GPA of 2.20 during two consecutive academic years may be suspended from the University. If it is the first suspension, it may be withdrawn by the concerned Head of the Department on receipt of an application from the student and on being satisfied that the student will make every effort from then on to improve his/her grade but this can only be done after the student has gone through at least a full semester of suspension. However, a second suspension will be regarded as final and absolute.

In all bachelor degree programs, the students are required to attend minimum 60% of the classes held in each subject in a semester failing which they will not be allowed to sit for the Semester Final Examination & Clearance Examination. THE GUARDIANS ARE REQUESTED TO MONITOR THE ATTENDANCE AND PERFORMANCE OF THEIR WARDS THROUGH THE UNIVERSITY AT LEAST ONCE IN THE MIDDLE OF THE SEMESTER. However, the authority may

condone the shortage of requisite percentage on grounds acceptable to the authority.

<u>A student failing in any sessional/practical work will have to repeat the semester.</u>

Graduating students securing a CGPA (Cumulative Grade Point Average) of 3.75 or above will be included in the Dean's List of Honor.

Chapter 3	Faculty Members

Head

Prof. Dr. Abdur Rahim Mollah, B.Sc.(EEE), BUET, M.Sc. (UMIST, UK), Ph.D. (R.G University, UK).

Professors

1. Prof. Dr. Abdur Rahim Mollah, B.Sc.(EEE), BUET, M.Sc.(UMIST, UK), Ph.D (R.G University, UK).

2. Prof. Dr. Satyen Biswas, B.Sc.(EEE), BUET, M.Sc. Engg.(Japan), Ph.D (Yamaguchi University, Japan), P.E.(Canada).

Associate Professors

1. M. Abul Hussain, B.Sc.(EEE), RU, B.Sc.(EEE), REC,(RMCS), M.Sc. Engg. (UMIST) UK.

2. Golam Mostafa, B.Sc. (EEE), BUET, M.Sc. (CSE), BUET.

3. Dr. A.K.M. Ehtesanul Islam, B.Sc.(EEE), BUET, M. Engg. and Dr. of Engg. MIT (Hokkaido) Japan.

4. Md. Masoodur Rahman Khan, B.Sc.(EEE), BUET, M.S. (EE), Florida, USA.

5. Mohammad Mahfujur Rashid, B.Sc.(EEE), AUST, M.Sc. (EEE), BUET.

6. Dr. Md. Riazul Hamid, M.Sc.(Elec.), and Ph.D.(USSR).

7. Dr. Tareq Aziz, B.Sc.(EEE), BUET, M.Sc.(EEE), BUET, Ph.D (Australia)

8. Dr. A.K.M. Baki, B.Sc.(EEE), BUET, M.Sc.(Germany), Ph.D (Japan)

Expert Faculty Member

Md. Jamal Uddin Ahmed, B.Sc.(EEE), BUET, M.Sc.(CE), WSU, Dayton, Ohio, USA.

Assistant Professors

1. A.K.M. Jahangir Alam Majumder, B.Sc.(EEE), AUST, M.Sc.(EEE), BUET. [On leave for Ph.D degree in the USA].

2. Ahmadullah Siddiq, B.Sc.(EEE), AUST.

3. Monjur Morshed, B.Sc.(EEE), BIT(Chittagong), M.Sc.(CT), Germany.

4. Ismat Zareen B.Sc.(EEE), AUST, M.Sc.(EEE), BUET.

5. Bobby Barua, B.Sc.(EEE), AUST, M.Sc.(EEE), BUET. [On leave for Ph.D degree in Italy]

6. Md. Meganur Rahman, B.Sc.(EEE), AUST, M.Engg (EEE), BUET.

7. Mohammad Tawhidul Alam, B.Sc.(EEE), DUET, M.Sc. (EEE), BUET.

8. Md. Jakaria Rahimi, B.Sc.(EEE), BUET, M.Sc.(EEE), BUET.

9. Anupama Tasneem, B.Sc.(EEE), AUST.

10. Md. Shariful Islam, B.Sc.(EEE), BUET, M.Sc.(EEE), BUET.

11. Mohammad Ziaur Rahman, B.Sc.(EEE), AUST, M.Sc.(EEE), BUET.

12. Omar Farrok, B.Sc.(EEE), RUET, M.Sc.(EEE), RUET.

13. Russel Reza Mahmud, B.Sc.(EEE), IUT, M.Sc.(EEE), RUET.

14. Nahyan Al Mahmud, B.Sc.(EEE), AUST.

15. M. M. Atiqur Rahman, B.Sc.(EEE), AUST. [On leave for M.Sc. degree in Saudi Arabia]

16. Zannatul Ferdous, B.Sc.(EEE), AUST.

17. Khandakar Mohammad Ishtiak, B.Sc.(EEE), AUST.

18. Ahammad, B.Sc.(EEE), IUT.

19. Md. Minhaz Akram B.Sc.(EEE), IUT, M.Sc.(IT), TUT, Finland

20. Hasib Md. Abid Bin Farid, B.Sc.(EEE), IUT, M.Sc.(EEE), IUT.

Lecturers

1. Palash Sarker, B.Sc.(EEE), BUET. [On leave for Ph.D degree in the USA]

2. Towhid Adnan Chowdhury, B.Sc.(EEE), BUET, M.Sc.(EEE), USA.

3. Md. Asker Ibna Shaikh, B.Sc.(EEE), MIST. [On leave for M.Sc. degree in Canada]

4. Safayat-Al-Imam, B.Sc.(EEE), AUST, M.A.Sc.(ECE), Canada.

5. Estiak Ahmed, B.Sc.(EEE), AUST, M.Sc.(EEE), BUET. [On leave for Ph.D degree in the USA]

6. Kazi Ahmed Ahsan, B.Sc.(EEE), AUST. [On leave for M.Sc. degree in Australia]

7. Aziz-Un-Nur Ibn Saif, B.Sc.(EEE), IUT.[On leave for M.Sc. degree in Netherlands]

8. Ata-E-Rabbi, B.Sc.(EEE), AUST, [On leave for M.Sc. degree in Belgium]

9. Khondoker Lubaba Bashar, B.Sc.(EEE), AUST.

10. Rubaiya Binte Hussain, B.Sc.(EEE), AUST.[On leave for M.Sc. degree in Germany]

11. Md. Imtiaz Alamgir, B.Sc.(EEE), AUST.[On leave for M.Sc. degree in Germany]

12. Aminur Rahman, B.Sc.(EEE), AUST.

13. Kazi Khurshidi Haque Dia, B.Sc.(EEE), AUST.

14. Shaila Arif, B.Sc.(EEE), AUST.

15. Md. Faysal Nayan, B.Sc.(EEE), AUST.

16. Monirul Islam, B.Sc.(EEE), AUST.

17. Kazi Tauseef Mohaamad, B.Sc.(EEE), IUT.

18. Taniza Marium, B.Sc.(EEE), AUST.

19. Sharmin Sobhan, B.Sc.(EEE), AUST.

20. Samia Binte Kazemi, B.Sc.(EEE), BUET.

21. Md. Sariful Islam, B.Sc.(EEE), BUET.

22. Israt Jahan, B.Sc.(EEE), AUST.

23. Md. Abu Shahab Mollah, B.Sc.(EEE), KUET.

24. Md. Saiful Arefin Mojumder, B.Sc.(EEE), BUET.

25. Tanvir Ahmed, B.Sc.(EEE), AUST.

26. Shuvashish Das Gupta, B.Sc.(EEE), AUST.

27. Pallabi Sutradhar, B.Sc.(EEE), AUST.

28. Sumit Naryan Saurov, B.Sc.(EEE), BUET.

29. Naznin Sultana, B.Sc.(EEE), BUET.

30. Dewan Monzurul Islam, B.Sc.(EEE), BUET.

31. Istiaque Rahaman, B.Sc.(EEE), IUT.

Chapter 4 — Courses for B.Sc. in Electrical and Electronic Engineering

4.1   Introduction and Course Identification

The undergraduate students of different years of this department have to follow the course schedule given. The letter prefix in any course number indicates the department offering the courses or the discipline viz. EEE for Electrical and Electronic Engineering, ARCH for Architecture, CSE for Computer Science and Engineering, CE for Civil Engineering, MPE for Mechanical Engineering, CHEM for Chemistry, PHY for Physics, MATH for Mathematics and HUM for Humanities.

Each course is designated by a two to four letter word identifying the department which offers it followed by a four digit number with the following criteria:

a)   The first digit corresponds to the year in which the course is taken by the student.
b)   The second digit represents the semester in which the course is taken by the student.
c)   The third digit is reserved for departmental use for such things as to identify different areas within a department.
d)   The last digit is 'odd' for a theoretical course and 'even' for a laboratory or sessional course.

The third digit of the course number has the following meaning:

Digit   0 and 1 is for Core courses
         2 for Interdisciplinary group
         3 and 4 for Electronics group
         5 and 6 for Power group
         7 and 8 for Communication group
         9 for Computer group

The course designation system is illustrated by the following example:

EEE 1 1 0 1   Electrical Circuits I

- Course title
- Last odd digit designates a theoretical
- Third digit '0' represents a core course
- Second digit '1' signifies First semester
- First digit '1' means First year
- Department identification code
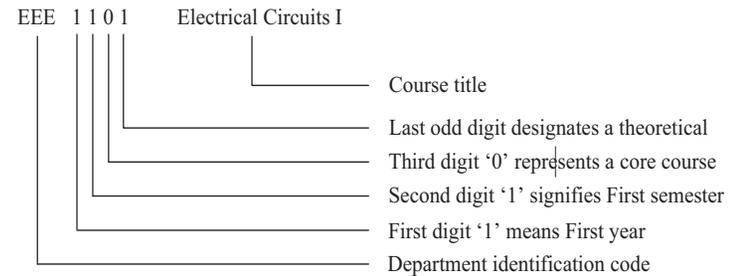
The minimum hours to be completed for obtaining the degree of B.Sc. in Electrical and Electronic Engineering is 210 of which 120 hours (Each course 3 Contact hours/week) are for theoretical courses and 90 hours for laboratory courses (Each course 3 contact hours/week) with a total credit of 165.0.

The semester-wise distribution of credits of different years is listed below:

Year	Semester	Theory Hour	Lab Hour	Total Hour	Total Credit
1	1	15	12	27	21
1	2	15	9	24	19.5
2	1	15	12	27	21
2	2	15	12	27	21
3	1	15	9	24	19.5
3	2	15	9	24	19.5
4	1	15	15	30	22.5
4	2	15	12	27	21
Total		120	90	210	165

4.2 Core Courses

Some of the core courses are identified as pre-requisite courses. A pre-requisite course is one which is required to be completed before some other course(s) can be taken. Any such course, on which one or more subsequent courses build up, may be offered in each of the two regular semesters.

4.2.1 Core Courses (EEE)

Sl. No.	Course Number	Course Title	Credit Hour
1	EEE 1101	Electrical Circuits I	3.0
2	EEE 1102	Electrical Circuits I Lab.	1.5
3	EEE 1201	Electrical Circuits II	3.0
4	EEE 1202	Electrical Circuits II Lab.	1.5
5	EEE 1210	Electrical Circuit Simulation Lab.	1.5
6	EEE 2103	Electronics I	3.0
7	EEE 2104	Electronics I Lab.	1.5
8	EEE 2105	Energy Conversion I	3.0
9	EEE 2106	Energy Conversion I Lab.	1.5
10	EEE 2109	Programming Language	3.0
11	EEE 2110	Programming Language Lab.	1.5
12	EEE 2203	Electronics II	3.0
13	EEE 2204	Electronics II Lab.	1.5
14	EEE 2205	Energy Conversion II	3.0
15	EEE 2206	Energy Conversion II Lab.	1.5
16	EEE 2210	Electronic Circuit Simulation Lab.	1.5
17	EEE 2211	Measurement and Instrumentation	3.0
18	EEE 2212	Measurement and Instrumentation Lab	1.5
19	EEE 3100	Electrical Service Design	1.5
20	EEE 3103	Digital Electronics I	3.0
21	EEE 3104	Digital Electronics I Lab.	1.5
22	EEE 3107	Signals and Linear Systems	3.0
23	EEE 3110	Numerical Technique Lab.	1.5

Sl. No.	Course Number	Course Title	Credit Hour
24	EEE 3113	Electrical Properties of Materials	3.0
25	EEE 3117	Electromagnetics	3.0
26	EEE 3203	Solid State Devices	3.0
27	EEE 3205	Power System I	3.0
28	EEE 3207	Communication Theory	3.0
29	EEE 3208	Communication Theory Lab.	1.5
30	EEE 3209	Microprocessor, Interfacing and System design	3.0
31	EEE 3210	Microprocessor, Interfacing and System design Lab.	1.5
32	EEE 3217	Digital Signal Processing I	3.0
33	EEE 3218	Digital Signal Processing I Lab.	1.5
34	EEE 4100	Project and Thesis	3.0
35	EEE 4105	Control System I	3.0
36	EEE 4106	Control System I Lab.	1.5
37	EEE 4200	Project and Thesis	3.0
		Total	**85.5**

4.2.2 Core Courses (Humanities)

Sl. No.	Course Number	Course Title	Credit Hour
1	HUM 2109	English and Sociology	3.0
2	HUM 2110	Developing English Skills Lab.	1.5
3	HUM 2209	Accounting and Economics	3.0
4	HUM 3109	Industrial Management	3.0
5	HUM 4229	Society, Ethics and Technology (SET)	3.0
		Total	**13.5**

4.2.3 Core Courses (Mathematics)

Sl. No.	Course Number	Course Title	Credit Hour
1	MATH 1103	Mathematics I	3.0
2	MATH 1203	Mathematics II	3.0
3	MATH 1213	Mathematics III	3.0
4	MATH 2103	Mathematics IV	3.0
5	MATH 2203	Mathematics V	3.0
		Total	15.0

4.2.4 Core Courses (Physics)

Sl. No.	Course Number	Course Title	Credit Hour
1	PHY 1105	Physics I	3.0
2	PHY 1106	Physics I Lab.	1.5
3	PHY 1205	Physics II	3.0
		Total	7.5

4.2.5 Core Courses (Chemistry)

Sl. No.	Course Number	Course Title	Credit Hour
1	CHEM 1107	Chemistry	3.0
2	CHEM 1108	Chemistry Lab.	1.5
		Total	4.5

4.2.6 Core Courses (CE)

Sl. No.	Course Number	Course Title	Credit Hour
1	CE 1201	Mechanics of Materials	3.0
2	CE 1202	Engineering Drawing with AutoCAD	1.5
		Total	4.5

4.2.7 Core Courses (MPE)

Sl. No.	Course Number	Course Title	Credit Hour
1	ME 1101	Mechanical Engineering Fundamentals	3.0
2	ME 1102	Mechanical Engineering Fundamentals Lab.	1.5
		Total	4.5

4.3 Elective Courses

From Year-4, Semester-1, Department of EEE starts offering elective courses under 4 groups viz. Power, Electronics, Communication and Computer. Besides these, one elective course is to be chosen from interdisciplinary group.

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

1. Students will be assigned one of the four groups as major and another as minor by taking written options from the students. For regular students, this will be done in Year-3, Semester-1.

2. Maximum number of students in any group as major will be N/4, where N is the number of students in a batch. Similarly the maximum number of students in any group as minor will also be N/4.

3. Major and minor group assignment will be based on options and CGPA of first four terms from Year-1, Semester-1 to Year-3, Semester-1.

4. A student will have to take 4 or 5 elective theory course from the respective major group and 3 or 2 elective theory courses from the respective minor group. A student must also take one theory course along with its corresponding sessional from the interdisciplinary group.

5. Students will be assigned their Year-4 projects/ theses from the area of their respective major group.

6. If a student fails in an elective theory course that has a sessional, the student may take the theory course again or may take another theory course together with its corresponding sessional.

7. Maximum class size of an elective course for regular students will be (N/4 + 5). However, a student who has previously failed in an elective course will be allowed to re-regular regardless of the class size.

8. Elective courses to be offered in a term will be distributed in the preceding term.

9. A student will be allowed to choose a course from his/her major group regardless of his/her CGPA. After distribution of the elective courses among the students of the respective major groups, remaining seats of the elective courses will be distributed among the students who have chosen the subject's group as their minor. The distribution among the minor students will be based on their written options for their courses and CGPA at the time of the distribution.

10. In case of any unforeseen situation or ambiguity, the Department will take an appropriate decision.

The numbering system of the courses in elective groups will follow the rule described earlier. The third digit of a course number will define the group of the course according to the following criteria:

Digit : 2 for Interdisciplinary group
3 and 4 for Electronics group
5 and 6 for Power group
7 and 8 for Communication group
9 for Computer group

4.3.1 Power Group

Sl. No.	Course Number	Course Name	Credit Hour
1	EEE 4151	Energy Conversion III	3.0
2	EEE 4153	Power System II	3.0
3	EEE 4154	Power System II Lab	1.5
4	EEE 4155	Power Plant Engineering and Economy	3.0
5	EEE 4157	High Voltage Engineering	3.0
6	EEE 4158	High Voltage Engineering Lab.	1.5
7	EEE 4251	Power System Protection	3.0
8	EEE 4252	Power System Protection Lab.	1.5
9	EEE 4253	Power System Reliability	3.0
10	EEE 4255	Power System Operation and Control	3.0

4.3.2 Electronics Group

Sl. No	Course Number	Course Name	Credit Hour
1	EEE 4131	Processing and Fabrication Technology	3.0
2	EEE 4133	VLSI I	3.0
3	EEE 4134	VLSI I Lab.	1.5
4	EEE 4135	Analog Integrated Circuit	3.0
5	EEE 4137	Digital Electronics II	3.0
6	EEE 4138	Digital Electronics II Lab	1.5
7	EEE 4231	VLSI II	3.0
8	EEE 4232	VLSI II Lab.	1.5
9	EEE 4233	Optoelectronics	3.0
10	EEE 4235	Compound Semiconductor and Hetero-Junction Devices	3.0
11	EEE 4237	Biomedical Instrumentation	3.0

| 12 | EEE 4238 | Biomedical Instrumentation Lab. | 1.5 |
| 13 | EEE 4239 | Semiconductor Device Theory | 3.0 |

4.3.3 Communication Group

Sl. No.	Course Number	Course Name	Credit Hour
1	EEE 4171	Digital Signal Processing II	3.0
2	EEE 4173	Microwave Engineering	3.0
3	EEE 4174	Microwave Engineering Lab.	1.5
4	EEE 4175	Optical Fiber Communication	3.0
5	EEE 4177	Random Signals and Processes	3.0
6	EEE 4178	Random Signals and Processes Lab	1.5
7	EEE 4271	Digital Communication	3.0
8	EEE 4272	Digital Communication Lab.	1.5
9	EEE 4273	Mobile Cellular Communication	3.0
10	EEE 4275	Telecommunication Engineering	3.0

4.3.4 Computer Group

Sl. No.	Course Number	Course Name	Credit Hour
1	EEE 4193	Microcontroller based System Design	3.0
2	EEE 4194	Microcontroller based System Design Lab.	1.5
3	EEE 4195	Real Time Computer System	3.0
4	CSE 4291	Computer Networks	3.0
5	CSE 4292	Computer Networks Lab.	1.5
6	CSE 4293	Computer Architecture	3.0
7	EEE 4295	Multimedia Communications	3.0

4.3.5 Interdisciplinary Courses

Sl. No.	Course Number	Course Name	Credit Hour
1	EEE 4221	Control System II	3.0
2	EEE 4222	Control System II Lab.	1.5
3	EEE 4225	Numerical Methods for Engineering	3.0
4	EEE 4226	Numerical Methods for Engineering Lab.	1.5
5	EEE 4227	Power Electronics	3.0
6	EEE 4228	Power Electronics Lab.	1.5

Chapter 5   ℂourse Offering

5.1   Course Distribution

Courses are offered to the students as per following arrangement:

Year-1 Semester-1

Course No.	Course Title	Credit
EEE 1101	Electrical Circuits I	3.0
EEE 1102	Electrical Circuits I Lab.	1.5
ME 1101	Mechanical Engineering Fundamentals	3.0
ME 1102	Mechanical Engineering Fundamentals Lab.	1.5
PHY 1105	Physics I	3.0
PHY 1106	Physics I Lab.	1.5
MATH 1103	Mathematics I	3.0
CHEM 1107	Chemistry	3.0
CHEM 1108	Chemistry Lab.	1.5
	Total	21.0

Year-1 Semester-2

Course No.	Course Title	Credit
EEE 1201	Electrical Circuits II	3.0
EEE 1202	Electrical Circuits II Lab.	1.5
EEE 1210	Electrical Circuit Simulation Lab.	1.5
PHY 1205	Physics II	3.0
MATH 1203	Mathematics II	3.0
MATH 1213	Mathematics III	3.0
CE 1201	Mechanics of Materials	3.0
CE 1202	Engineering Drawing with AutoCAD	1.5
	Total	19.5

Year-2 Semester-1

Course No.	Course Title	Credit
EEE 2103	Electronics I	3.0
EEE 2104	Electronics I Lab.	1.5
EEE 2105	Energy Conversion I	3.0
EEE 2106	Energy Conversion I Lab.	1.5
EEE 2109	Programming Language	3.0
EEE 2110	Programming Language Lab.	1.5
MATH 2103	Mathematics IV	3.0
HUM 2109	English and Sociology	3.0
HUM 2110	Developing English Skills Lab.	1.5
	Total	21.0

Year-2 Semester-2

Course No.	Course Title	Credit
EEE 2203	Electronics II	3.0
EEE 2204	Electronics II Lab.	1.5
EEE 2205	Energy Conversion II	3.0
EEE 2206	Energy Conversion II Lab.	1.5
EEE 2210	Electronic Circuit Simulation Lab.	1.5
EEE 2211	Measurement and Instrumentation	3.0
EEE 2212	Measurement and Instrumentation Lab	1.5
MATH 2203	Mathematics V	3.0
HUM 2209	Accounting and Economics	3.0
	Total	21.0

Year-3 Semester-1

Course No.	Course Title	Credit
EEE 3103	Digital Electronics I	3.0
EEE 3104	Digital Electronics I Lab.	1.5
EEE 3107	Signals and Linear Systems	3.0
EEE 3110	Numerical Technique Lab.	1.5
EEE 3113	Electrical Properties of Materials	3.0
EEE 3100	Electrical Service Design	1.5
EEE 3117	Electromagnetics	3.0
HUM 3109	Industrial Management	3.0
	Total	19.5

Year-3 Semester-2

Course No.	Course Title	Credit
EEE 3203	Solid State Devices	3.0
EEE 3205	Power System I	3.0
EEE 3207	Communication Theory	3.0
EEE 3208	Communication Theory Lab.	1.5
EEE 3209	Microprocessor, Interfacing and System design	3.0
EEE 3210	Microprocessor, Interfacing and System design Lab.	1.5
EEE 3217	Digital Signal Processing I	3.0
EEE 3218	Digital Signal Processing I Lab.	1.5
	Total	19.5

Year-4 Semester-1

Course No.	Course Title	Credit
EEE 4100	Project and Thesis	3.0
EEE 4105	Control System I	3.0
EEE 4106	Control System I Lab.	1.5
EEE ****	Elective I	3.0
EEE ****	Elective I Lab.	1.5
EEE ****	Elective II	3.0
EEE ****	Elective II Lab.	1.5
EEE ****	Elective III	3.0
EEE ****	Elective IV	3.0
	Total	22.5

Year-4 Semester-2

Course No.	Course Title	Credit
EEE 4200	Project and Thesis	3.0
EEE ****	Elective V	3.0
EEE ****	Elective VI	3.0
EEE ****	Elective VI Lab.	1.5
EEE ****	Elective VII	3.0
EEE ****	Elective VIII	3.0
EEE ****	Elective VIII Lab.	1.5
HUM 4229	Society, Ethics and Technology (SET)	3.0
	Total	21.0

5.2   Elective Course divisions

Eight elective courses (Elective I – Elective VIII) are offered to the students according to the following list. Elective I - IV are offered at Year-4, Semester-1 and Elective V – Elective VIII are offered to the students of Year-4, Semester-2.

Elective I

Group	Course Number	Course Title	Credit Hour Indiv.	Total
Electronics	EEE 4137	Digital Electronics II	3.0	
	EEE 4138	Digital Electronics II Lab	1.5	4.5
Power	EEE 4153	Power System II	3.0	4.5
	EEE 4154	Power System II Lab	1.5	
Communication	EEE 4177	Random Signals and Processes	3.0	4.5
	EEE 4178	Random Signals and Processes Lab	1.5	

Elective II

Group	Course Number	Course Title	Credit Hour Indiv.	Total
Electronics	EEE 4133	VLSI I	3.0	4.5
	EEE 4134	VLSI I Lab.	1.5	
Power	EEE 4157	High Voltage Engineering	3.0	4.5
	EEE 4158	High Voltage Engineering Lab.	1.5	
Communication	EEE 4173	Microwave Engineering	3.0	
	EEE 4174	Microwave Engineering Lab.	1.5	4.5

Computer	EEE 4193	Microcontroller based System Design	3.0	
	EEE 4194	Microcontroller based System Design Lab.	1.5	4.5

Elective III

Group	Course Number	Course Title	Credit Hour
Electronics	EEE 4131	Processing and Fabrication Technology	3.0
Power	EEE 4151	Energy Conversion III	3.0
Communication	EEE 4171	Digital Signal Processing II	3.0

Elective IV

Group	Course Number	Course Title	Credit Hour
Electronics	EEE 4135	Analog Integrated Circuit	3.0
Power	EEE 4155	Power Plant Engineering and Economy	3.0
Communication	EEE 4175	Optical Fiber Communication	3.0
Computer	EEE 4195	Real Time Computer System	3.0

Elective V

Group	Course Number	Course Title	Credit Hour
Electronics	EEE 4233	Optoelectronics	3.0
Power	EEE 4253	Power System Reliability	3.0
Communication	EEE 4273	Mobile Cellular Communication	3.0
Computer	CSE 4293	Computer Architecture	3.0

Elective VI

Group	Course Number	Course Title	Credit Hour Indiv.	Total
Electronics	EEE 4231/ EEE 4237	VLSI II/ Biomedical Instrumentation	3.0	
	EEE 4232/ EEE 4238	VLSI II Lab./ Biomedical Instrumentation Lab.	1.5	4.5
Power	EEE 4251	Power System Protection	3.0	4.5
	EEE 4252	Power System Protection Lab	1.5	
Communication	EEE 4271	Digital Communication	3.0	4.5
	EEE 4272	Digital Communication Lab.	1.5	
Computer	CSE 4291	Computer Networks	3.0	4.5
	CSE 4292	Computer Networks Lab.	1.5	

Elective VII

Group	Course Number	Course Title	Credit Hour
Electronics	EEE 4235/	Compound Semiconductor and Hetero-Junction Devices/	3.0
	EEE 4239	Semiconductor Device Theory	
Power	EEE 4255	Power System Operation and Control	3.0
Communication	EEE 4275	Telecommunication Engineering	3.0
Computer	CSE 4295	Multimedia Communications	3.0

Elective VIII

Group	Course Number	Course Title	Credit Hour Indiv.	Total
Interdisciplinary	EEE 4221	Control System II	3.0	
	EEE 4222	Control System II Lab.	1.5	4.5
	EEE 4227	Power Electronics	3.0	4.5
	EEE 4228	Power Electronics Lab.	1.5	
	EEE 4225	Numerical Methods for Engineering	3.0	4.5
	EEE 4226	Numerical Methods for Engineering Lab.	1.5	

Chapter 6   Course Contents

6.1   Core Courses offered by the Department of EEE

Year-1 Semester-1

EEE 1101   **Electrical Circuits I**
3 Credits, 3 hours/week

Circuit Variables and Elements:
Voltage, current, power, energy, independent and dependent sources, resistance.

Basic Laws of Electrical Circuits:
Ohm's law, Kirchoff's Current Law (KCL) and Kirchoff's Voltage Law (KVL).

Simple Resistive Circuits:
Series and parallel circuits, voltage and current division, Source transformation, wye-delta transformation.

Techniques of Network Analysis:
Nodal and Mesh analysis including supernode and supermesh.

Network Theorems:
Thevenin's, Norton's and superposition theorems with applications in circuits having independent and dependent sources, maximum power transfer condition and reciprocity theorem.

Energy Storage Elements:
Inductors and capacitors, their characteristics, series-parallel combination of inductors and capacitors.

Responses of RL and RC Circuits:
Natural and step responses.

Magnetic Quantities and Variables:
Flux, permeability and reluctance, magnetic field strength, magnetic potential, flux density, magnetization curve, Laws in

magnetic circuits: Ohm's law and Ampere's circuital law. Series, parallel and series-parallel magnetic circuits.

EEE 1102   **Electrical Circuits I Lab.**
1.5 Credits, 3 hours/week

Laboratory experiments based on theory and concepts learnt in EEE 1101.

Year-1 Semester-2

EEE 1201   **Electrical Circuits II**
3 Credits, 3 hours/week

Alternating Current Basics:
Instantaneous current, voltage, power, effective current and voltage, average power, phasors and complex quantities, impedance, real and reactive power, power factor.

Analysis of Single Phase AC Circuits:
Series and parallel RL, RC and RLC circuits, Resonance in AC circuits, Series and parallel resonance. Q of a circuit, nodal and mesh analysis, application of network theorems in AC circuits. Circuits with non-sinusoidal excitations, transients in AC circuits, passive filters. Magnetically couple circuits.

Analysis of Poly Phase Circuits:
Poly phase supply, 3-phase conditions, balanced and unbalanced circuits, power calculation.

EEE 1202   **Electrical Circuits II Lab.**
1.5 Credits, 3 hours/week

Laboratory experiments based on theory and concepts learnt in EEE 1201.

EEE 1210   **Electrical Circuit Simulation Lab.**
1.5 Credits, 3 hours/week

Simulation laboratory based on EEE 1101 and EEE 1201 theory courses. Verification of the theories and concepts learned in EEE

1101 and EEE 1201 using simulation software like PSPICE and MATLAB.

Year-2 Semester-1

EEE 2103   Electronics I
3 Credits, 3 hours/week

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

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

Bipolar Junction Transistor (BJT):
Current components, BJT characteristics and regions of operation, BJT as an amplifier, biasing the BJT for discrete circuits, small signal equivalent circuit models, BJT as a switch.

BJT Amplifier Circuits:
Voltage and current gain, input output impedance of common base, common emitter and common collector amplifier circuits, multistage amplifiers.

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

Junction Field-Effect-Transistor (JFFET):
Structure and physical operation of JFET, transistor characteristics, pinch-off voltage.

EEE 2104   Electronics I Lab.
1.5 Credits, 3 hours/week

Laboratory experiments based on theory and concepts learnt in EEE 2103.

EEE 2105   Energy Conversion I
3 credits, 3 hours/week

Transformer:
Ideal transformer- transformation ratio, no-load and load vector diagrams; actual transformer- equivalent circuit, regulation, short circuit and open circuit tests. Three phase transformer and its V-connection; Vector group of three phase transformers.

Three Phase Induction Motor:
Rotating magnetic field, equivalent circuit, vector diagram, torque-speed characteristics, effect of changing rotor resistance and reactance on torque-speed curves, motor torque and developed rotor power, no-load test, blocked rotor test, starting and braking and speed control.

Single Phase Induction Motor:
Theory of operation, equivalent circuit and starting.

EEE 2106   Energy Conversion I Lab.
1.5 Credits, 3 hours/week

Laboratory experiments based on theory and concepts learnt in EEE 2105.

EEE 2109   Programming Language
3 credits, 3 hours/week

Introduction to digital computers; Programming languages, algorithms and flow charts; Structured programming using C: Variables and constants, operators, expressions, control statements, functions, array, pointer, structure union, user defined data types, input-output files.

Object oriented programming using C++: Introduction, classes and objects, polymorphism, function and operator overloading, inheritance.

EEE 2110   Programming Language Lab.
1.5 credits, 3 hours/week

Laboratory experiments based on theory and concepts learnt in EEE 2109.

Year-2 Semester-2

EEE 2203   Electronics II
3 Credits, 3 hours/week

Frequency Response of Amplifiers:
Poles, Zeros and Bode plots, amplifier transfer function, techniques of determining 3 dB frequencies of amplifier circuits, frequency response of single-stage and cascade amplifiers, frequency response of differential amplifiers.

Operational Amplifiers (Op-Amp):
Properties of ideal OP-Amps, non-inverting and inverting amplifiers, inverting integrators, differentiator, weighted summer and other applications of Op-Amp circuits, Electronic Analog computation Schmitt trigger, Differential Amp, Differential and Common gain, comparator, effects of finite open loop gain and bandwidth on circuit performance, logic operation of Op-Amp, DC imperfections. DC analysis, small-signal analysis of different stages, gain and frequency response of 741 OP-Amp.

Feedback Amplifier:
Properties, basic topologies, feedback amplifiers with different topologies, stability, frequency compensation.

Active Filters:
Different types of filters and specifications, transfer functions, realization of first and second order low, high and band pass filters using OP-Amps.

Stability and Oscillators:
Sinusoidal oscillators, Phase shift oscillator, resonant circuit oscillator, general form of oscillator circuit, wein-bridge oscillator, crystal oscillators.

Power Amplifiers:
Classification of output stages, Class A, B and AB output stage, Class C and Class D.

EEE 2204   Electronics II Lab.
1.5 Credits, 3 hours/week

Laboratory experiments based on theory and concepts learnt in EEE 2203.

EEE 2205   Energy Conversion II
3 Credits, 3 hours/week

Synchronous Generator:
Windings, excitation systems, equivalent circuit, vector diagrams at different loads, factors affecting voltage regulation, synchronous impedance, synchronous impedance methods of predicting voltage regulation and its limitations. Parallel operation: necessary conditions, synchronizing, circulating current and vector diagram.

Synchronous Motor:
Operation, effect of loading under different excitation condition, effect of changing excitation, V-curves and starting.

DC Generators:
Types, no-load voltage characteristics, build up of a self excited shunt generator, critical field resistance, load-voltage characteristic, effect of speed on no-load and load characteristics and voltage regulation.

DC Motor:
Torque, counter emf, speed, torque-speed characteristics, starting and speed regulation. Introduction to wind turbine generators. Construction and basic characteristics of solar cells.

EEE 2206   Energy Conversion II Lab.
1.5 Credits, 3 hours/week

Laboratory experiments based on theory and concepts learnt in EEE 2205.

EEE 2210   Electronic Circuit Simulation Lab.
1.5 Credits, 3 hours/week

Simulation Laboratory based on EEE 2103 and EEE 2203 theory courses. Verification of the theories and concepts learned in EEE 2103 and EEE 2203 using simulation software's like PSPICE and MATLAB.

EEE 2211   Measurement and Instrumentation
3 Credits, 3 hours/week

Introduction:
Applications, functional elements of a measurement system and classification of instruments.

Measurement of Electrical Quantities:
Current and voltage, power and energy measurement. Current and voltage, power and energy measurement Current and potential transformer.

Transducers:
Mechanical, electrical and optical transducers.

Measurement of Non-Electrical Quantities:
Temperature, pressure, flow, level, strain, force and torque, earthquake, speed, frequency, phase difference.

Basic Elements of DC and AC Signal Conditioning:
Instrumentation amplifier, noise and source of noise, noise elimentation compensation, function generation and linearization, A/D and D/A converters, sample and hold circuits.

Data Transmission and Telemetry:
Methods of data transmission, DC/AC telemetry system and digital data transmission. Recording and display devices. Data

acquisition system and microprocessor applications in instrumentation.

EEE 2212   Measurement and Instrumentation Lab.
1.5 Credits, 3 hours/week

Laboratory experiments based on theory and concepts learnt in EEE 2211.

Year-3 Semester-1

EEE 3100   Electrical Service Design
1.5 Credits, 3 hours/week

Wiring system design, drafting, estimation; Design for illumination and lighting; Electrical installation system design: substation, BBT and protection, air conditioning, heating and lifts; Design of security system including CCTV, fire alarm, smoke detector, burglar alarm and sprinkler system; A design problem on a multi-stored building using AutoCAD.

EEE 3103   Digital Electronics I
3 Credits, 3 hours/week

Analysis and Synthesis of Digital Logic Circuits:
Number system and codes. Boolean algebra, De Morgan's law, logic gates and truth tables, combinational logic design, minimization techniques, implementation of basic static logic gates in CMOS and BiCMOS. Arithmetic and data handling logic circuits, decoders and encoders, multiplexers and combinational circuit design.

Programmable Logic Devices:
Logic arrays, Field Programmable Logic Arrays and Programmable Read Only Memory.

Sequential Circuits:
Different types of latches, flip-flops and their design using ASM approach, timing analysis, timing analysis and power optimization of sequential circuits. Modular sequential logic circuit design: Shift registers, counters and their applications.

EEE 3104   Digital Electronics I Lab.
1.5 Credits, 3hours/week

Laboratory experiments based on theory and concepts learnt in EEE 3103. Design of simple systems using the principles learned in EEE 3103.

EEE 3107   Signals and Linear Systems
3 Credits, 3 hours/week

Classification of Signal and Systems:
Signals- classification, basic operation on signals, elementary signals, representation of signal 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, static equation and time domain solution.

Frequency Domain Analysis of LTI Systems:
Fourier series- properties, harmonic representation, system response, frequency response of LTI systems; Fourier transformation- properties, system transfer function, system response and distortion less systems.

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

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

Analogous Systems:
Electrical, mechanical and electro-mechanical systems.

EEE 3110   Numerical Technique Lab.
1.5 Credits, 3 hours/week

Laboratory on numerical techniques using computer solution of differentiation and integration problems, transcendental equations, linear and non-linear differential equations and partial differential equations.

EEE 3113   Electrical Properties of Materials
3 Credits, 3 hours/week

Atoms and Aggregates of Atoms:
Bohr atomic model, shell model.

Bonding and Types of Solids:
Primary bonding, secondary bonding, mixed bonding.

Crystal Structures:
Types of crystals, lattice and basis, Bravais lattice and Miller indices.

Classical Theory of Electrical and Thermal Conduction:
Scattering, mobility and resistivity, temperature dependence of metal resistivity, Mathiessen's rule, Hall effect and thermal conductivity.

Modern Theory of Metals:
Determination of Fermi energy and average energy of electrons, classical and quantum mechanical calculation of specific heat.

Dielectric Properties of Materials:
Polar and nonpolar dielectrics, dielectric constant, polarization-electronic, ionic and orientational; internal field, Clausius-Mosotti equation, spontaneous polarization, frequency dependency of dielectric constant, dielectric loss, piezoelectricity, ferroelectricity.

Magnetic Properties of Materials:
Magnetic moment, magnetization and relative permeability, different types of magnetic materials, origin of ferromagnetism and magnetic domains, coercive force, polycrystalline and permanent magnetic materials, introduction to superconductivity: Zero resistance and Meissner effect, Type I and Type II superconductors and critical current density.

Band Theory of Solids:
Band theory from molecular orbital, Bloch theorem, Kronig-Penny model, effective mass, density of states.

Quantum Mechanics:
Wave nature of electrons, Schrödinger's equation, one dimensional quantum problems- infinite quantum well, potential step and potential barrier; Heisenberg's uncertainty principle and quantum box.

Carrier Statistics:
Maxwell-Boltzmann and Fermi-Dirac distributions, Fermi energy.

EEE 3117   Electromagnetics
3 Credits, 3 hours/week

Review of Vector Analysis:
Coordinate Systems, Vector algebra, gradient, divergence and curl.

Static Electric Field:
Postulates of electrostatics, Coulomb's law for discrete and continuously distributed charges, force, field intensity, flux density, Gauss's law and its applications, electric potential due to charge distribution, conductors and dielectrics in static electric field, boundary conditions; capacitance- electrostatic energy and forces, energy in terms of field equations, capacitance calculations of different geometries; boundary value problems- Poisson's and Laplace's equations in different co-ordinate systems, method of images, graphical field mapping.

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

Time Varying Fields and Maxwell's Equations:
Faradays law of electromagnetic induction, Maxwell's equations- differential and integral forms, boundary conditions, potential functions; time harmonic fields and Poynting theorem, depth of penetration, internal impedance, power loss.

Plane Electromagnetic Wave:
Plane wave in lossless media- Doppler effect, transverse electromagnetic wave, Polarization of plane wave; plane wave in lossy media- low loss dielectrics, good conductors; transmission line analogy- reflection coefficient, transmission coefficient, characteristics impedance, standing wave ratio, group velocity, instantaneous and average power densities, normal and oblique incidence of plane waves at plane boundaries for different polarization.

Year-3 Semester-2

EEE 3203   Solid State Devices
3 Credits, 3 hours/week

Semiconductors in Equilibrium:
Electronic model of semiconductors and solids, valance band model, valance band, energy gap, conduction band, Energy bands, filling the energy band levels by electrons, energy band diagram of semiconductors, E-K, E-x, intrinsic and extrinsic semiconductors, Fermi levels, concept of holes, electron and hole concentrations, mass action law, charge neutrality conditions, temperature dependence of carrier concentrations and invariance of Fermi level.

Carrier Transport Processes and Excess Carriers:
Drift and diffusion, lattice scattering and impurity scattering generation and recombination of excess carriers, built-in-field.

Electric field dependence of mobility Einstein relations, Boltzman relations, continuity and diffusion equations for holes and electrons and quasi-Fermi level. Trapping and Tunneling.

PN Junction:
Basic structure, equilibrium conditions, contact potential, equilibrium Fermi level, DC electrical characteristics of p-n junction, energy band diagram of a biased p-n junction, Shockley diode equation, charge control switching analysis of p-n junction. 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 turn on and turn off transients, metal semiconductor diode, band diagram.

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 equations and circuit synthesis, switching transients, deviation from ideal behavior.

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 C-V characteristics, charge control modes, qualitative theory of MOSFET operation, body effect and current-voltage relationship of a MOSFET.

Junction Field Effect Transistor:
Introduction, qualitative theory of operation, pinch off voltage and current-voltage relationship.

EEE 3205   Power System I
3 Credits, 3 hours/week

Inductance and capacitance of power transmission line; Line representation: resistance, skin effect, ferranti effect, equivalent circuit of short, medium and long line; Power factor and voltage control in power system; Introduction to corona and its effects; Tap changing transformer: OFF load and ON load tap changing, regulating transformer, boosting transformer; Mechanical characteristic of overhead transmission line: sag and tension analysis, effect of temperature, wind and ice loading, supports of different levels, dampers, insulators of overhead lines; Underground cables; Distribution system: distributor calculation of radial feeders, ring mains and interconnections; Introduction to flexible AC transmission system (FACTS).

EEE 3207   Communication Theory
3 Credits, 3 hours/week

Overview of Communication Systems:
Basic principles, fundamental elements, system limitations, message source, bandwidth requirements, transmission media types, bandwidth and transmission capacity.

Noise:
Source, characteristics of various types of noise and S/N ratio.

Information Theory:
Measure of information, source encoding, error free communication over a noisy channel, channel capacity of a continuous system and channel capacity of a discrete memoryless system, communication entropy, data compression.

Communication Systems:
Analog and digital communication, carrier, baseband, bandpass and broadband communication; broadcast- and point to point-mode of communication.

Continuous Wave Modulation:
AM- DSB, SSB, VSB, QAM, spectral analysis of each type, envelope and synchronous detection; angle modulation-

instantaneous frequency, FM, PM, spectral analysis, demodulation of FM and PM.

Pulse Modulation:
Sampling- sampling theorem, Nyquist criterion, aliasing, instantaneous and natural sampling; PAM principle, bandwidth requirements; PCM- quantization principle, quantization noise, non-uniform quantization, signal to quantization error ratio, demodulation of PCM, DPCM and DM principle, adaptive DM; line coding formats and bandwidths.

Digital Modulation:
ASK principle, bandwidth requirements, detection, noise performance; PSK principle, bandwidth requirements, detection, DPSK, QPSK- noise performance, FSK- principle, continuous and discontinuous phase FSK, detection of FSK, MSK- bandwidth requirements.

Multiplexing:
TDM- principle, receiver synchronization, frame synchronization, TDM of multiple bit rate systems; FDM- principle, demultiplexing; WDM, multiple access network- TDMA, FDMA, CDMA- spread spectrum multiplexing, coding technique and constraints of CDMA.

Communication Systems Design:
Design parameters, channel selection criteria and performance simulation

Brief Introduction to Some Communication Systems:
Mobile cellular communication system, Fiber optic communication system, Microwave communication system and Satellite communication system.

EEE 3208   Communication Theory Lab.
1.5 Credits, 3 hours/week

Laboratory experiments based on theory and concepts learnt in EEE 3207. Design of simple systems using the principles learned in EEE 3207.

EEE 3209   Microprocessor, Interfacing and System design
3 Credits, 3 hours/week

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

16-bit Architecture:
Pin diagram and functions, memory organization, bus activities, register layout, internal processing blocks.

Instruction Set:
Classifications of instructions, addressing modes, address computing chart.

I/O Controller Programming:
Port definition and read/write instructions, parallel I/O programming using 8255, serial I/O programming using 8251, display programming using 8279 and LCD, keyboard programming using 8279 and discrete components, generation of timing functions using 8253 PIT controller.

Interrupt Structure:
Interrupt terminologies, hardware and software interrupt, multiple interrupt management.

Data Conversion Algorithm:
Number system and BCD arithmetic, BCD2BIN conversion, BIN2BCD conversion, binary multiplication, binary division.

System Design (8086 based digital weighing machine: DWM)
Topdown/Bottomup design concept, hardware block diagram, control program flow chart, weight/rate acquisition and processing and display, cost computation and processing and display.

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

80386 architecture, instruction and programming; overview of CISC and RISC microcontrollers, instruction and programming.

EEE 3210 Microprocessor, Interfacing and System design Lab.
1.5 Credits, 3 hours/week

Laboratory experiments based on theory and concepts learnt in EEE 3209. Design of simple systems using the principles learned in EEE 3209.

EEE 3217 Digital Signal Processing I
3 Credits, 3 hours/week

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

Discrete Transformations:
Discrete Fourier series, discrete-time Fourier series, discrete Fourier transform (DFT) and properties, fast Fourier transform (FFT), inverse fast Fourier transform, Z-transformation-properties, transfer function, poles and zeroes and inverse Z-transform.

Correlation:
Circular convolution, auto correlation and cross correlation.

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

EEE 3218 Digital Signal Processing I Lab.
1.5 Credits, 3 hours/week

Laboratory experiments based on theory and concepts learnt in EEE 3217. Design of simple systems using the principles learned in EEE 3217.

Year-4 Semester-1

EEE 4100 Project and Thesis
3 Credits, 6 hours/week

The students are required to undertake a project in the field of Electrical and Electronic Engineering. The objective is to provide an opportunity to the students to develop initiative, creative ability, confidence and engineering judgment. The results of the work should be submitted in the form of a dissertation, which should include appropriate drawings, charts, tables, references etc.

EEE 4105 Control System I
3 Credits, 3 hours/week

Introduction to Control Systems:
Linear system models- transfer function, block diagram and signal flow graph (SFG).

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

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

Analysis of Feedback Control System:
Root locus method and frequency response method.

Design of Feedback Control System:
Controllability and observability, root locus, frequency response and state variable methods.

Digital Control Systems:
Introduction, sampled data systems, stability analysis in Z-domain.

EEE 4106   Control System I Lab.
1.5 Credits, 3 hours/week

Laboratory experiments based on theory and concepts learnt in EEE 4105.

Year-4 Semester-2

EEE 4200   Project and Thesis
3 Credits, 6 hours/week

The students are required to undertake a project in the field of Electrical and Electronic Engineering. The objective is to provide an opportunity to the students to develop initiative, creative ability, confidence and engineering judgment. The results of the work should be submitted in the form of a dissertation, which should include appropriate drawings, charts, tables, references etc.

6.2   Elective Courses offered by the Department of EEE

6.2.1   Interdisciplinary Group

EEE 4221   Control System II
3 Credits, 3 hours/week

Compensation using pole placement technique; State equations of digital systems with sample and hold; state equations of digital systems; digital simulation and approximation; Solution of discrete state equations: by Z-transform, state equation and transfer function, state diagrams and state plane analysis; Stability of digital control systems; Digital simulation and digital redesign; Time domain analysis; Frequency domain analysis;

Controllability and observability; Optimal linear digital regulator design; Digital state observer; Microprocessor control: Introduction to neutral network and fuzzy control adaptive control, H_α control, nonlinear control.

EEE 4222   Control System II Lab.
1.5 Credits, 3 hours/week

Laboratory experiments based on theory and concepts learnt in EEE 4221

EEE 4225   Numerical Methods for Engineering
3 Credits, 3 hours/week

Introduction:
Motivation and errors in numerical techniques, Taylor series.

Finite Difference Calculus:
Forward, backward, divided, and central difference and difference of a polynomial.

Interpolation and Extrapolation:
Newton's formula, lagrange, spline, chebyshev and inverse; extrapolation.

Nonlinear Equations:
Iteration, bisection, false position, Raphson, Secant and Muller's methods.

Simultaneous Linear Algebratic Equations:
Cramer's rule, inversion of matrices, Gauss elimination, Gauss-Jordon method, factorization and Gauss-Siedel iteration methods.

Curve Fitting:
Linear and polynomial regression, fitting power, exponential and trigonometric functions, ordinary differential equations: initial value problem, Taylors series method, Picard's method of successive approximation, Euler's method and Runge Kutta method. Boundary value problems.

Numerical Integration:
General quardrature formula, trapezoidal rule and Simpson's rule; numerical differentiation.

EEE 4226   Numerical Methods for Engineering Lab.
1.5 Credits, 3 hours/week

Laboratory experiments based on theory and concepts learnt in EEE 4225.

EEE 4227   Power Electronics
3 Credits, 3 hours/week

Power semiconductor switches and triggering devices: BJT, MOSFET, SCR, IGBT, GTO, TRIAC, UJT and DIAC; Rectifiers: Uncontrolled and controlled single phase and three phase; Regulated power supplies: Linear-series and shunt, switching buck, buckboost, boost and cuk regulators; AC voltage controllers: single and three phase; Choppers; DC motor control; Single phase cycloconverter; Inverters: single phase and three phase current and voltage source AC motor control; Stepper motor control; Resonance inverters; Pulse width modulation control of static converters.

EEE 4228   Power Electronics Laboratory
1.5 Credits, 3 hours/week

Laboratory experiments based on theory and concepts learnt in EEE 4227. Design of simple systems using the principles learned in EEE 4227.

6.2.2   Power Group

EEE 4151   Energy Conversion III
3 credits, 3 hours/week

Special Machines:
Series universal motor, permanent magnet DC motor, unipolars and bipolar brush less DC motors, stepper motor and control circuits. Reluctance and hysteresis motors with drives circuits, switched reluctance motor, electro static motor, repulsion motor,

synchronous and control transformers, Permanent magnet synchronous motors.

Acyclic Machines:
Generators, conduction pump and induction pump.

Magneto Hydrodynamic Generators:
Fuel cells, thermoelectric generators, flywheels, vector control, linear motors and traction.

Photovoltaic Systems:
Stand alone and grid interfaced.

Wind Turbine Generators:
Induction generator, AC-DC-AC conversion.

EEE 4153   Power System II
3 Credits, 3 hours/week

Power network representations; per unit system of calculations; power and reactive power flow in simple systems; load flow studies of large systems using the Gauss Seidel methods; control of voltage; real power and reactive power; symmetrical fault calculations; limitation of short-circuit currents using regulators.

Symmetrical components: positive, negative and zero sequence networks of generators, transformers and lines; sequence network of systems; unsymmetrical fault calculations.

Power system stability involving two-machine systems; swing equation; Equal area criterion of stability and its applications; solution of swing equation factors affecting transient stability; Harmonics of power system: causes and effects of harmonics generation in power system.

EEE 4154   Power System II Lab.
1.5 Credits, 3 hours/week

Laboratory experiments based on theory and concepts learnt in EEE 4153.

EEE 4155   Power Plant Engineering and Economy
3 Credits, 3 hours/week

Power Plants
General layout and principles, steam turbine, gas turbine, combined cycle, hydro and nuclear. Plant performance and operation characteristics,

Selection of Location
Technical, economical and environmental factors, load forecasting.

Generation Scheduling
Deterministic and probabilistic generation, load curves- demand factor, diversity factor, load duration curve, energy load curves, load factor, capacity factor, plant factor, electricity tariff formulation and type.

Busbar layout
Different kinds of busbars in a substation and their advantages and disadvantages.

EEE 4157   High Voltage Engineering
3 Credits, 3 hours/week

High voltage DC: Rectifiers circuits, voltage multipliers, Van-de-Graaf and electrostatic generators; High voltage AC: Cascaded transformers and Tesla coils; Impulse voltage: 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; Corona; High voltage measurements and testing; Over-voltage phenomenon and insulation coordination; Lightning and switching surges; basic insulation level; surge diverters and arresters.

EEE 4158   High Voltage Engineering Lab.
1.5 Credits, 3 hours/week

Laboratory experiments based on theory and concepts learnt in EEE 4157. Design of simple systems using the principles learned in EEE 4157.

EEE 4251   Power System Protection
3 Credits, 3 hours/week

Purpose of power system protection; Criteria for detecting faults: over current, differential current, difference of phase angles, over and under voltages, power direction, symmetrical components of current and voltages, impedance, frequency and temperature; Electromechanical, electronic and digital relays: basic modules, over current, differential, distance and directional; Trip circuits; Different protection schemes for generator, transformer, motor, bus bar, transmission lines; Protection of ring mains and radial feeders; Miniature circuit breakers and fuses; Circuit breakers: principle of arc extinction, selection criteria and ratings of circuit breakers, types-air, oil, SF6 and vacuum.

EEE 4252   Power System Protection Lab.
1.5 Credits, 3 hours/week

Laboratory experiments based on theory and concepts learnt in EEE 4251.

EEE 4253   Power System Reliability
3 Credits, 3 hours/week

Review of probability concepts; Probability distribution: Binomial, Poission, and Normal; Reliability concepts: Failure rate, outage, mean time to failure, series and parallel systems and redundancy; Markov process; Probabilistic generation and load models; Reliability indices: Loss of load probability and loss of energy probability; Frequency and duration; Reliability evolution techniques of single area system.

EEE 4255   Power System Operation and Control
3 Credits, 3 hours/week

Principles of power system operation: SCADA, convention and competitive environment; Unit commitment; static security analysis; state estimation; optimal power flow; automatic generation control and dynamic security analysis.

6.2.3   Electronics Group

EEE 4131   Processing and Fabrication Technology
3 Credits, 3 hours/week

Monolithic Fabrication Processes and Structures:
Substrate materials: Crystal growth and wafer preparation. Basic MOS process, Basic Bipolar process, Photolithographic process, pattern generation, pattern transfer, mask alignment, soft and hard baking, Photomask fabrication. Thermal oxidation, oxide quality, oxide thickness characterization.

Cleaning:
Surface cleaning, organic cleaning and RCA cleaning.

Diffusion:
Mathematical model, constant source diffusion, limited source diffusion, two-step diffusion, sheet resistance.Diffusion systems: Boron, Phosphorous, Ion implementation.

Etching:
Wet chemical etching, silicon and GaAs etching, anisotropic etching, selective etching, dry physical etching, ion beam etching, sputtering etching and reactive ion etching.

Film Deposition:
Evaporation, sputtering, CVD, Epitaxy.

Isolation:
p-n 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.

Interconnection, contacts, packaging and testing.

EEE 4133   VLSI I
3 Credits, 3 hours/week

VLSI Technology:
Top down design approach, technology trends and design styles. Verilog coding of electronic devices.

Review of MOS Transistor Theory:
Threshold voltage, body effect, I V equations and characteristics, latch-up problems, NMOS inverter, CMOS inverter, pass-transistor and transmission gates. CMOS circuit characteristics and performance estimation: Resistance, Capacitance, rise and fall times, delay, gate transistor sizing and power consumption.

CMOS Circuit and Logic Design:
Layout design rules and physical design of simple logic gates.

CMOS Subsystem Design:
Adder, multiplier and memory system, ALU.

VLSI Design Styles:
FPGA, Standard cell based design, Full custom design.

EEE 4134   VLSI I Lab.
1.5 Credits, 3 hours/week

Laboratory experiments based on theory and concepts learnt in EEE 4133. Design of simple systems using the principles learned in EEE 4133.

EEE 4135   Analog Integrated Circuit
3 Credits, 3 hours/week

Introduction:
Review of FET amplifiers, passive and active loads and frequency limitation. CMOS circuit modeling: Large signal model, model parameters, second order model effects.

Current Sink and Source, Current Mirror:
Basic, cascode and active current mirror and current amplifiers. Differential Amplifier: Introduction, large and small signal analysis, common mode analysis and differential amplifier with active load. Op-amp design methodology, two stage Op-amp design, cascade Op-amp. Current and voltage references. Band-gap references: Supply voltage independent biasing, temperature independent biasing, proportional to absolute temperature current generation and constant transconductance biasing.

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

Switch Capacitor Circuit:
Sampling switches, switched capacitor circuits including unity gain buffer, amplifier and integrator.

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

EEE 4137   Digital Electronics II
3 Credits, 3 hours/week

TTL:
TTL NAND gate operation, current-sourcing and current-sinking action, totem pole output circuit, TTL NOR gate, standard TTL characteristics, supply voltage and temperature range, voltage levels, power dissipation, propagation delay, fan out, introduction to improved TTL series, TTL loading and fan out, other TTL characteristics, connecting TTL outputs together, open collector output, Tri-state, TTL driving CMOS, problem with TTL.

ECL:
Basic ECL circuit, ECL OR/NOR gate, ECL characteristics, fan out, speed of operation.

CMOS Logic Families:
Introduction to the working principle of enhancement type NMOS, PMOS and depletion MOS. Comparison of NMOS and PMOS

with respect to speed. Design of NOMS inverter with resistive load, with NMOS enhancement load and with NMOS depletion load. Edge time and speed calculation for NMOS inverter with depletion load. CMOS inverter: Circuit diagram, operation, transfer characteristic and noise margin. Design of basic CMOS gates (NAND gate and NOR gate) with specified parameters (rise time and fall time). Circuit implementation from logic equations. NMOS pass transistors and CMPS pass gate. Implementation of multiplexer by NMOS and CMOS pass gate. Buffer circuit. CMOS gates driving TTL gates and comparison of CMOS logics with TTL logics. Design of basic logic gates using CMOS and BiCMOS.

Interfacing Data Converters:
Digital to Analog Converters (D/A):
The binary weighted resistor D/A converter. The R/2R ladder D/A converter. The inverted ladder D/A converter. Specification for D/A converters (resolution, linearity, settling time and accuracy).

Analog to Digital Converters (A/D):
Flash converters, Successive approximation converter and Dual slope converter. A/D converter specifications (analog input voltage, input impedance, accuracy, conversion time etc.). A comparison of converter types. Sample and hold circuit (S/H), interconnecting the S/H circuit and the A/D converter.

EEE 4138   Digital Electronics II Lab
1.5 Credits, 3 hours/week

Laboratory experiments based on theory and concepts learnt in EEE 4137

EEE 4231   VLSI II
3 Credits, 3 hours/week

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

Design Entry Tools:
Schematic capture and HDL. Logic and switch level simulation. Static timing. Concepts and tools of analysis, solution techniques

for floor planning, placement, global routing and detailed routing. Application specific integrated circuit design including FPGA.

EEE 4232   VLSI II Lab.
1.5 Credits, 3 hours/week

Laboratory experiments based on theory and concepts learnt in EEE 4231. Design of simple systems using the principles learned in EEE 4231.

EEE 4233   Optoelectronics
3 Credits, 3 hours/week

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

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

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

Stimulated Emission and Light Amplification:
Spontaneous and stimulated emission, Einstein relations, population inversion, absorption of radiation, optical feedback and threshold conditions.

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

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

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

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

EEE 4235   Compound Semiconductor and Hetero-Junction Devices
3 Credits, 3 hours/week

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

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

Hetero-Junction Diode:
Band banding, carrier transport and I-V characteristics.

Hetero-Junction Field Effect Transistor:
Structure and principle, band structure, carrier transport and I-V characteristics.

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

EEE 4237   Biomedical Instrumentation
3 Credits, 3hours/week

Human Body:
Cells and physiological systems.

Bioelectricity:
Genesis and characteristics.

Measurement of Bio-Signals:
Etical issues, transducers, amplifiers and filters.

Electrocardiogram:
Electrocardiography, phonocardiograph, vector cardiograph, analysis and interpretation of cardiac signals, cardiac pacemakers and defibrillator.

Blood Pressure:
Systolic, diastolic mean pressure, electronic manometer, detector circuits and practical problems in pressure monitoring.

Blood Flow Measurement:
Plethymography and electromagnetic flow meter.

Measurement and Interpretation:
Electroencephalogram, cerebral angiograph and cronical X-ray, brain scans, elecromayogram (EMG).

Tomograph:
Positron emission topography and computer tomography, magnetic resonance imaging, ultrasonogram, patient monitoring system and medical telemetry, effect of electromagnetic fields on human body.

EEE 4238   Biomedical Instrumentation Lab.
1.5 Credits, 3 hours/week

Laboratory experiments based on theory and concepts learnt in EEE 4237

EEE 4239   Semiconductor Device Theory
3 Credits, 3 hours/week

Lattice Vibration:
Simple harmonic model, dispersion relation, acoustic and optical phonons.

Band Structure:
Isotropic and anisotropic crystal, band diagram and effective masses of different semiconductor and alloys.

Scattering Theory:
Review of classical theory, Fermi-Golden rule, scattering of different processes, scattering mechanism in different semiconductors, mobility.

Different Carrier Transport Models:
Drift-diffusion theory, ambipolar transport, hydrodynamic model, Boltzman transport equations, quantum mechanical model, simple application.

6.2.4   Communication Group

EEE 4171   Digital Signal Processing II
3 Credits, 3 hours/week

Spectral Estimation:
Nonparametric methods- discrete random processes, autocorrelation sequence, periodogram. Parametric methods-autoregressive modeling, forward/backward linear prediction, Levinson-Durbin algorithm, minimum variance method and Eigenstructure method I and II.

Adaptive Signal Processing:
Application, equalization, interference suppression, noise cancellation, FIR filters, minimum mean-square error criterion, least mean-square algorithm and recursive least square algorithm.

Multirate DSP:
Interpolation and decimation, poly-phase representation and multistage implementation.

Perfect Reconstruction Filter Banks:
Power symmetric, alias-free multi-channel and tree structured filter banks.

Wavelets:
Short time Fourier transform, wavelet transform, discrete time orthogonal wavelets and continuous time wavelet basis.

EEE 4173   Microwave Engineering
3 Credits, 3 hours/week

Transmission Lines:
Voltage and current in ideal transmission lines, reflection, transmission, standing wave, impedance transformation, smith chart, impedance matching and lossy transmission lines.

Waveguides:
General formulation, modes of propagation and losses in parallel plate, rectangular and circular waveguides, transit time effect, velocity modulation, space charge wave.

Microstrips:
Structure and characteristics.

Rectangular Resonant Cavities:
Energy storage, losses and Q.

Radiation:
Small current element, radiation resistance, radiation pattern and properties, Hertzian and half wave dipoles.

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

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

EEE 4174   Microwave Engineering Lab.
1.5 Credits, 3 hours/week

Laboratory experiments based on theory and concepts learnt in EEE 4173. Design of simple systems using the principles learned in EEE 4173.

EEE 4175   Optical Fiber Communication
3 Credits, 3 hours/week

Light Propagation through Optical Fiber:
Ray optics theory and mode theory.

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

Light Sources:
Light emitting diodes and laser diodes.

Detectors:
PIN photo detector and avalanche photodetectors.

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

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

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

Multi-Channel Optical System:
Frequency division multiplexing, wavelength division multiplexing and co-channel interference.

EEE 4177   Random Signals and Processes
3 Credits, 3 hours/week

Probability and Random Variables:
Distribution and density functions and conditionals probability.

Expectation:
Moments and characteristic functions. Transformation of a random variable. Vector random variables. Joint distribution and density. Sum of random variables.

Random Processes:
Correlation functions. Process measurements. Gaussian and Poisson random processes. Noise models. Stationary and Ergodicity. Special Estimation. Correlation and power spectrum. Cross spectral densities. Response of linear systems to random inputs.

Introduction to Discrete Time Processes:
Mean square estimation, detection and linear filtering.

EEE 4178   Random Signals and Processes Lab
1.5 Credits, 3 hours/week

Laboratory experiments based on theory and concepts learnt in EEE 4177.

EEE 4271   Digital Communication
3 Credits, 3 hours/week

Introduction:
Communication channels, mathematical model and characteristics, probability and stochastic process.

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

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

Receiver for AWGN Channels:
Correlation demodulator, match filter demodulator and maximum likelihood receiver.

Channel Capacity and Coding:
Channel models and capacities and random selection of codes.

Block Codes and Conventional Codes:
Linear block codes, convolution codes and coded modulation, Spread spectrum signals and system.

EEE 4272   Digital Communication Lab.
1.5 Credits, 3 hours/week

Laboratory experiments based on theory and concepts learnt in EEE 4271. Design of simple systems using the principles learned in EEE 4271.

EEE 4273   Mobile Cellular Communication
3 Credits, 3 hours/week

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

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

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

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

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

Diversity Techniques:
Concept of diversity branch and signal paths, carrier to noise and carrier to interference ratio performance.

Digital Cellular Systems:
Global system for mobile, time division multiple access and code division multiple access. GSM, AMPS, GPRS, EDGE, W-CDMA, 3rd generation of mobile communication, Packet switching and data communication

EEE 4275   Telecommunication Engineering
3 Credits, 3 hour/week

Introduction:
Principle, evolution, networks, exchange and international regularly bodies.

Telephone Apparatus:
Microphone. Speakers, ringer, pulse and tone dialing mechanism, side-tone mechanism, local and central batteries and advanced features.

Switching System: Introduction to analog system, digital switching system-space division switching, blocking probability and multistage switching, time division switching and two dimensional switching, SPC, TST, STS.

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

Modern Telephone Services and Network:
Internet telephony, fascimile, integrated services digital network; asynchronous transfer mode and intelligent networks, introduction to cellular telephony and satellite communication.

6.2.5   Computer Group

EEE 4193   Microcontroller based System Design
3 Credits, 3 hours/week

Review of 8 bit/ 16 bit CISC/RISC microcontrollers: Hardwire architecture, First access register file, instruction pipelining.
System design: Digital taximeter, prepaid energymeter, VVVF driven and the like, advances in system design.

EEE 4194   Microcontroller based System Design Lab.
1.5 Credits, 3 hours/week

Laboratory experiments based on theory and concepts learnt in EEE 4193. Design of simple systems using the principles learned in EEE 4193.

EEE 4195   Real Time Computer System
3 Credits, 3 hours/week

Introduction to real time system; Classification of real time process; Real time scheduling; Real time programming; Implementation; Operating systems; Real Time I/O. Real time design methodologies; Modeling for real time systems; Reliable and safe design for critical applications; Review of Microprocessor fundamentals and programmable input/output devices and systems for PC; Application examples: digital controls, robotics, on line systems, communication with real world signals and automatic control using feedback, feed-forward and adaptive control, control algorithm implementation.

6.3   Courses offered by other Departments to EEE students

6.3.1   Department of Computer Science and Engineering

CSE 4291   Computer Networks
3 Credits, 3 hours/week

Switching and multiplexing; ISO; TCP-IP and ATM reference models; Different data communication services; Physical layer: wired and wireless transmission media; Cellular radio; Communication satellites; Data link layer: Elementary protocols, sliding window protocols; Error detection and correction; HDLC; DLL of internet; DLL of ATM; Multiple Access protocols: IEEE.802 protocols for LANs and MANs; switches; Hubs and Bridges; High speed LAN; Network layer: Routing, Congestion control, internetworking; Network layer in internet: IP protocol, IP addresses, ARP; NI in ATM transport layer: transmission control protocol, UDP, ATM adaptation layer; Application layer: Network

security; Email; Domain name system; Simple network management protocol; HTTP and World Wide Web.

CSE 4292　　　Computer Networks Lab.
1.5 Credits, 3 hours/week

Laboratory experiments based on theory and concepts learnt in EEE 4291. Design of simple systems using the principles learned in EEE 4292.

CSE 4293　　　Computer Architecture
3 Credits, 3 hours/week

Instructions and data access methods; Arithmetic Logic Unit (ALU) design: arithmetic and logical operations, floating point operations; Process design: data paths single cycle and multi cycle implementations; Control Unit Design: hardware and micro programmed Pipeline: pipeline data path and control, hazards and exceptions; Memory Organization: cache, virtual memory, buses, multiprocessor, type of microprocessor performance, single bus multiprocessors, clusters.

CSE 4295　　　Multimedia Communications
3 Credits, 3 hours/week

Types of media; Multimedia signal characteristic: sampling, digital representation, signal formats; Signal coding and compression: entropy coding, transform coding, vector quantization; Coding Standards: H.26x, LPEG, MPEG; Multimedia communication networks: network topologies and layers, LAN, MAN, WAN, PSTN, ISDN, ATM, internetworking devices; the internet and access technologies; enterprise networks; wireless LANs and wireless multimedia; Entertainment networks: cables, satellite and terrestrial TV networks; ADSL and VDSL; high speed modems; Transport protocols: TCP, UDP, IP, Ipv4, Ipv6, FTP, RTP, and RTCP; use of MPLS and WDMA; Multimedia synchronization; security; QoS and resource management; Multimedia applications: The www; Internet telephony; teleconferencing; HDVT; e-mail and e-commerce.

6.3.2　　Department of Civil Engineering

CE 1201　　　Mechanics of Materials
3 Credits, 3 hours/week

Stresses in members subjected to tension; compression; shear and temperature changes; Bending moment & shear force diagrams; Flexural & shear stresses in beams; torsional stresses in shaft; helical spring; thin & thick cylinders; principal stresses; deflection of beams; Columns.

CE 1202　　　Engineering Drawing with AutoCAD
1.5 Credits, 3 hours/week

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.

6.3.3　　Department of Mechanical and Production Engineering

ME 1101　　　Mechanical Engineering Fundamentals
3 Credits, 3 hours/week

Introduction to Sources of Energy:
Steam generating units with accessories and mountings, steam turbines, condensers, vapor cycles.

Internal Combustion Engine:
Introduction to internal combustion engines & their cycles, gas turbines.

Refrigeration and Air Conditioning:
Applications, refrigerants, different refrigeration methods.

Fluid Machinery:
Fluid flow, measurements of flow, friction in flow, centrifugal pumps, fans, blowers & compressors.

Fundamental of Conduction, Convection and Radiation:
One dimensional steady state conduction in plated pipes, Critical thickness of insulation.

ME 1102   Mechanical Engineering Fundamentals Lab.
1.5 Credits, 3 hours/week

Laboratory experiments based on theory and concepts learnt in ME 1101. Design of simple systems using the principles learned in ME 1101.

6.3.4   Department of Related Subjects

6.3.4.1   Physics

PHY 1105   Physics I
3 Credits, 3 hours/week

Waves and Oscillations:
Simple harmonic motion, 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, vibrations of membrances and columns, progressive wave, power and intensity of wave, stationary wave, energy calculation of progressive and stationary wave, group and phase velocities, sound waves- Doppler Effect, Sabines formula, architectord acoustics.

Optics:
Defects of images: Spherical aberration, astigmatism, coma, distortion, curvature, chromatic aberration, theories of light, Haygen's principle; Interference of light: Young's double slit experiment, displacement of fringes and its uses, Fresnel bi-prism, interference in thin film, 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, Malus law, polarization by double refraction, Nicol prism, optical activity,

polarimeters, optics of crystal optical effect in crystal, laser, nonlinear optics.

Thermal Physics:
Heat and work, Zeroth law of thermodynamics, thermometer, thermocouple, the first law of thermodynamics and its applications; Kinetic theory of gases- kinetic interpretation of temperature, specific heats of ideal gases, equipartition of energy, mean free path, work done by gas, isothermal and adiabatic relations, vandar waal's equation of state, Maxwell's distribution of molecular speeds, reversible and irreversible processes, Carnot's cycle, second law thermodynamics, Carnot's theorem, entropy, thermodynamic functions, Maxwell relations, Clausius and Clapeyron equation.

PHY 1106   Physics I Lab.
1.5 Credits, 3hours/week

Laboratory experiments based on theory and concepts learnt in PHY 1105.

PHY 1205   Physics II
3 Credits, 3 hours /week

Atomic Structure:
Rutherford scattering, atomic structure (Bohr model, Thomson model, Rutherford model), Zeeman effect.

Structure of Matter:
Classification of solids, crystal structure of solids, Bragg's law, distinction between metal, insulator and semiconductor.

Modern Physics:
Galilean relatively and Einstein's special theory of relativity; Lorentz transformation equations, Length contraction, time dilation and mass-energy relation, photoelectric effect, Compton effect, De'Broglie matter waves.

Nuclear Physics:
Constituent of atomic nucleus, Nuclear binding energy, different types of radioactivity, radioactive decay law; Nuclear reactions, nuclear fission, nuclear fusion.

Mechanics:
Linear momentum of a particle, linear momentum of a system of particles, conservation of linear momentum, some applications of the momentum principle; Angular momentum of a particle, angular momentum of a system of particles, Kepler's law of planetary motion, the law of Universal Gravitation, the motion of planets and satellites.

Introductory Quantum Mechanics:
Wave function, uncertainty principle, postulates, Schrödinger time independent equation, expectation value, probability, particle in a Zero potential, calculation of energy.

6.3.4.2 Chemistry

CHEM 1107 Chemistry
3 Credits, 3 hours/week

Atomic Structure; quantum numbers; Pauli's exclusion principle; electronic configuration; periodic table; properties and uses of noble gases; different types of chemical bonds and their properties; molecular structures of compounds; selective organic reactions; Different types of solutions and their compositions; Phase rule; phase diagram of monocomponent system; Properties of dilute solutions; Thermochemistry; chemical kinetics; chemical equilibriam; Ionization of water and pH concept; Electrical properties of solution.

CHEM 1108 Chemistry Lab.
1.5 Credits, 3 hours/week

Volumetric analysis: acid-base titration, oxidation-reduction titrations, determination of Fe, Cu and Ca volumetrically.

6.3.4.3 Mathematics

MATH 1103 Mathematics I
3 Credits, 3 hours/week

Differential Calculus:
Limits, continuity and differentiability. Successive differentiation of various types of functions. Leibnitz's theorem, Rolle's theorem, Mean value theorem, Taylor's and Maclaurin's theorems in finite and infinite forms. Lagrange's form of remainders. Cauchy's form of remainders. Expansion of functions, evaluations of indeterminate forms of L'Hospital's rule. Partial differentiation. Euler's theorem. Tangent and normal. Subtangent and subnormal in cartesian and polar co-ordinates. Determination of maximum and minimum values of functions. Curvature, Asymptotes, curve tracing.

Integral Calculus:
Definition, Integration by the method of substitution, integration by parts. Standard Integrals. Integration by successive reduction. Definite Integrals, its properties and use in summing series. Walli's formulae. Improper integrals. Beta function and Gamma function, Area under a plane curve and area of a region enclosed by two curves in Cartesian and polar co-ordinates, Trapezoidal and Simpson's rule, Volumes and surface areas of solids of revolution.

MATH 1203 Mathematics II
3 Credits, 3 hours/week

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

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.

MATH 1213   Mathematics III
3 Credits, 3 hours/week

Complex Variable:
Complex number system, General functions of a complex variable, Limits and continuity of a function of complex variable and related theorems, Complex differentiation and the Cauchy-Riemann equations, Mapping by elementary functions, Infinite series, Convergence and uniform convergence, Line integral of a complex function, Cauchy's integral formula, Liouville's theorem, Taylor's and Laurent's theorem, Singular points, Residue, Cauchy's residue theorem, Contour intergration, conformal mapping.

Vector Analysis:
Scalers and vectors, equality of vectors, addition and subtraction of vectors, geometrical interpretation, Multiple product of vectors, Linear dependence and independence of vectors, Differentiation and Integration of vectors together with elementary applications, Line, Surface and volume integrals, Gradient of a scalar functions, divergence and curl of a vector function, various formulae, Integrals form of gradient, divergence and curl, Divergence theorem, Stoke's theorem, Green's theorem and Gauss's theorem.

MATH 2103   Mathematics IV
3 Credits, 3 hours/week

Linear Algebra:
Introduction to systems of linear equations, Gaussian elimination, Definition of matrices, Algebra of matrices, Transpose of a matrix and inverse of matrix, Factorization, Determinants, Quadratic forms, Matrix polynomials, Euclidean n-space, Linear transformation from IR^n to IR^m, Properties of Linear transformation from IR^n to IR^m, Real vector spaces and subspaces. Basis and dimension, Rank and nullity, Inner product spaces, Gram-Schmidt process and QR-decomposition, Eigenvalues and eigenvectors, Diagonalization, Linear transformations, Kernel and Range, Application of linear algebra to electric networks.

Laplace Transformation:
Definition, Laplace transforms of some elementary functions, Sufficient conditions for existence of Laplace transforms, Inverse Laplace transforms, Laplace transforms of derivatives, Some special theorems on Laplace transforms, Partial fraction, Solution of differential equations by Laplace transforms, Evaluation of improper integrals.

MATH 2203   Mathematics V
3 Credits, 3 hours/week

Fourier Analysis:
Real and complex forms, Finite Fourier transforms, Fourier integral, Fourier transforms and their uses in solving boundary value problems.

Statistics:
Introduction, Frequency distribution, Mean, median, mode. Standard deviation, moments, skewness and kurtosis, Sets and Probability, Random variable and its probability distributions, Treatment of grouped sampled data, Some discrete probability distributions, Normal distribution, Binomial, poison and negative binomial, Sampling theory, Estimation theory, Tests of hypotheses, Regression and correlation, Analysis of variance.

6.3.4.4   Humanities

HUM 2109   English and Sociology
3 Credits, 3 hours/week

English:

General Discussion:
Introduction, various approaches of 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, précis writing, amplification.

General Strategies for 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, writing of reports.

Sociology:
Scope, Some basic concepts, Social evolution and techniques of production, culture and civilization, Social structure of Bangladesh, Population and world resources, Oriental and Occidental societies, Industrial revolution, Family-urbanization and industrialization, Urban ecology, Co-operative and Socialist movements, Rural Sociology.

HUM 2110   Developing English Skills Lab.
1.5 Credits, 3 hours/week

Grammar:
Tense, article, proposition, subject-verb agreement, clause, conditional and sentence structure.

Vocabulary Building:
Correct and precise diction, affixes, level of appropriateness. Colloquial and standard, informal and formal.

Developing Reading Skill:
Strategies of reading-skimming, scanning, predicting, inferencing; Analyzing and interpreting variety of texts; Practicing comprehension from literary and nonliterary texts.

Developing Writing Skill:
Sentences, sentence variety, generating sentences; Clarity and correctness of sentences, linking sentences to form paragraphs, writing paragraphs, essays, reports, formal and informal letters.

Developing Listening Skill and Note Taking:
Listening to recorded texts and class lectures and learning to take useful notes based on listening.

Developing Speaking Skill:
Oral skills including communicative expressions for personal identification, life at home, giving advice and opinion, instruction and directions, requests, complains, apologies, describing people and places, narrating events.

HUM 2209   Accounting and Economics
3 Credits, 3 hours/week

Financial Accounting:
Objectives and importance of accounting, branches of accounting, accounting as an information system, computerized system and applications in accounting. Recording system: Double entry mechanism, accounts and their classification, accounting equation, accounting cycle journal, ledger, trial balance. Preparation of financial statements considering adjusting and

closing entries. Accounting concepts and conventions. Financial statements analysis and interpretation: ration analysis- tests for profitability, liquidity, solvency and overall measure.

Costs and Management Accounting:
Cost concept and classification. Segregation and mixed cost. Overhead cost: meaning and classification, allocation of overhead cost, overhead recovery method. Job order costing: preparation of job cost sheet and quotation price. Inventory valuation: absorption costing and variable costing technique. Cost volume profit analysis: meaning, breakeven analysis, contribution margin approach, sensitivity analysis, short-term investment decisions: Relevant and differential cost analysis; Linear programming. Long-term investment decisions: Capital budgeting, various techniques of evaluation of capital investment, investment appraisal under uncertainty, risk management, capital rationing. Concept of working capital, need for working capital, management of cash, stock debtors.

Economics:

Introduction:
Definition of Economics. Economics and Engineering.

Micro-Economics:
The theory of demand and supply and their elasticities. Price determination. Nature of an economic theory, applicability of economic theories to the problems of developing countries. Indifference curve technique. Marginal analysis. Production, production function, types of productivity. Rational region of production of an engineering firm. concepts of market and market structure. Cost analysis and cost function. Small scale production and large scale production. Optimization. Theory of distribution.

Macro-Economics:
Savings, investment, employment, National income analysis. Inflation. Monetary policy, fiscal policy and trade policy with reference to Bangladesh. Economics of development and planning.

HUM 3109   Industrial Management
3 Credits, 3 hours/week

Introduction:
Evolution, management function, organization and environment.

Operational Management:
Production planning, types of production systems, forecasting, ABC analysis, inventory control, work study.

Organization:
Theory and structure, coordination, span of control, authority delegation, groups, committee and task force, manpower planning.

Personnel Management:
Scope, importance, need hierarchy, motivation, job redesign, leadership, participative management, training, performance appraisal, wages & incentives, informal groups, organizational change and conflict.

Cost and Financial Management:
Elements of costs of products, depreciation, break-even analysis, investment analysis, benefit cost analysis.

Marketing Management:
Concepts, strategy, sales promotion, patent laws.

Technology Management:
Management of innovation and changes, technology life cycle. Case studies.

HUM 4229   Society, Ethics and Technology (SET)
3 Credits, 3 hours/week

Historical perspectives of technology, Social perspectives of technology, Ethical perspective of technology, Economics, Globalization and human rights, Information systems technology, Biomedical technology, Population and environment.

Chapter 7   Courses offered by the
Department of EEE for
Undergraduate students of
other Departments

7.1   Department of Architecture

ARC 3125   Building Sciences and Services III
(Electrical Equipment)
2 hours per week, 2 Cr.

Introduction to electrification in buildings; Electrical equipment and electrical installations in buildings; Standard practices and precautions.

7.2   Department of Civil Engineering

EEE 1131   Basic Electrical Technology
3 Credits, 3 hours/week

DC Circuits:
Electrical units and standards; Electrical network and circuit solution: Series, Parallel and mesh current methods; Measurement of electrical quantities: current, voltage, resistance. Measuring instruments: ammeter, voltmeter, wattmeter and millimeters.

AC Circuits:
Instantaneous Current, voltage and power, effective current and voltage, average power; Phasor algebra; Introduction to electrical wiring for residential and commercial loads.

Electrical Machines:
Familiarization with different types of electrical machines such as DC generator and motors, AC alternator, motors, transformers; working principal of transformers, induction motors; Introduction to electronic principles with simple application.

EEE 1132   Basic Electrical Technology Lab.
1.5 Credits, 3 hours/week

Laboratory experiments based on theory and concepts learnt in EEE 1131.

7.3   Department of Computer Science and Engineering

EEE 1241   Basic Electrical Engineering
3 Credits, 3 hours/week

DC Circuits:
Fundamental electrical concept and measuring units; DC voltage, current , resistance and power; Laws of electrical circuits and methods of network analysis; Principal of DC measuring apparatus; Laws of magnetic fields and method of solving simple magnetic circuits.

Alternating Current:
Instantaneous and rms current, voltage and power; average power for various combinations of R,L and C circuits; phasor representation of sinusoidal quantities, Introduction to three phase circuits.

EEE 1242   Basic Electrical Engineering Lab.
1.5 Credits, 3 hours/week

Laboratory experiments based on theory and concepts learnt in EEE 1241.

EEE 2141   Electronic Device and Circuits
3 Credits, 3 hours/week

Semiconductor Diode:
Junction diode characteristics; Operation and small signal models of diodes.

Bipolar Transistor:
Characteristics; BJT biasing and thermal stabilization; CE, CB, CC configurations; Small signal low frequency h-parameter models and hybrid -Π model.

Introduction to JFET, MOSFET and CMOS:
Biasing and application in switching circuits.

Oscillators:
Hartley, Colpitts and Wien-bridge oscillators.

Power Electronic Devices:
SCR, TRIAC, DIAC, UJT characteristics and application; Introduction to rectifiers, active filters, regulated power supply; Introduction to IC fabrication techniques.

EEE 2142   Electronic Device and Circuits Lab.
1.5 Credits, 3 hours/week

Laboratory experiments based on theory and concepts learnt in EEE 2141.

7.4   Department of Textile Engineering

EEE 2261   Elements of Electrical Engineering and
**   Electronics**
3 Credits, 3 hours/week

Basic Electrical Engineering:
DC fundamentals; Generators and their characteristics, motors and their characteristics; Speed control process.

AC Current and Devices:
AC fundamentals; Flow of AC through coils; Inductance and resistance in series and parallel, Flow of AC through capacitance; Inductance, resistance and capacitance in series and parallel, Power in AC circuits; Power factor and power factor improvement; Resistance circuit; Transformer; Poly phase circuits; Induction motors.

Substation:
Purpose; Substation equipments (HT, LT Switch gear etc.); Distribution board and sub distribution board.

System Network:
Typical distribution circuits; Cables and wiring systems and selection.

System Protection:
Types of faults; principles of protection; protective devices circuit breaker, switches.

Electrical Hazards:
Protection against shock and fire, Farthing and its importance, Procedure to be adopted when a person is in contact with alive conductor.
Electronics:
Amplifiers; rectifiers and Transistors, Diodes and their uses, Voltage amplification, power amplification, Photo sensor and transducers, Integrated Circuit (IC).

EEE 2262   Elements of Electrical Engineering and
**   Electronics Lab.**
1.5 Credits, 3 hours/week

Laboratory experiments based on theory and concepts learnt in EEE 2261.

7.5   Department of Mechanical and Production
**   Engineering**

EEE 1287   Basic Electrical Engineering
3 Credits, 3 hours/week

Basic Electrical Engineering:
Sources of energy: General structure of electrical power systems, Power transmission and distribution via overhead lines and underground cables, Steam, Hydraulic, Gas and Nuclear power generation.

DC Networks:
Kirchoff's laws, node voltage and mesh current methods, Delta-star and star-delta conversion, Superposition principle, Thevenins and Norton's theorems.

Single phase AC Circuits:
Single phase EMF generation, average and effective values of sinusoids, solution of R,L,C series circuits, the j operator, complex representation of impedances, phasor diagram, power factor, power in complex notation, solution of parallel and series, parallel circuits.

Three phase AC Circuits:
Three phase EMF generation, delta and Y connections, line and phase quantities, solution of three phase circuits, balanced supply voltage and balanced load, phasor diagram, measurement of power in three phase circuits, Three phase four wire circuits.

Magnetic Circuits:
Ampere's circuital law, B-H curve, solution of magnetic circuits, hysteresis and eddy current losses, relays, an application of magnetic force, basic principles of stepper motor.

Transformers:
Construction, EMF equation, ratings, phasor diagram on no load and full load, equivalent circuit, regulation and efficiency calculations, open and short circuit tests, auto-transformers.

Induction Motor:
The revolving magnetic field, principle of orientation, ratings, equivalent circuit, Torque-speed characteristics, starters for cage and wound rotor type induction motors.

DC Machines:
Construction, EMF and Torque equations, Characteristics of DC generators and motors, speed control of DC motors and DC motor starters.

Electrical Measuring Instruments:
DC PMMC instruments, shunt and multipliers, multimeters, moving iron ammeters and voltmeters, dynamometer, wattmeter, AC watthour meter, extension of instrument ranges.

EEE 1288   Electrical Engineering Sessional
1.5 Credits, 3 hours/week

Sessional works compatible to EEE 1287.

EEE 2187   Electrical Machines
3 Credits, 3 hours/week

Transformer:
Constructional features, equivalent circuit and phasor diagram - regulation and efficiency, parallel operation. Three phase transformer connections; Harmonic in transformers; Testing; Inrush current; Phase conversion; Autotransformer.

D.C Machines:
Construction, armature windings, armature voltage and torque equations, classification. D.C generators' performance characteristics; D.C motors- torque/speed characteristics, speed control and braking. Testing and efficiency.

Induction machines:
Constructional features and rotating magnetic field. Circuit model and phasor diagram. Steady state characteristics. Testing, starting and speed control. Time harmonics and space harmonics. Single phase induction motors - classification and equivalent circuit. Universal motors.

Synchronous machines:
Constructional features; synchronous generators and motors; equivalent circuit and phasor diagram; power and torque characteristics and capability curves. Parallel operation. Salient pole synchronous machine - phasor diagram and determination of synchronous reactances; starting and speed control of synchronous motors.

EEE 2188   Electrical Machines Sessional
1.5 Credits, 3 hours/week

Sessional works compatible to EEE 2187.

EEE 2285   Introduction to Analog and Digital Electronics
3 Credits, 3 hours/week

Intrinsic and extrinsic semiconductors; operational principle of a p-n junction diode, contact potential and biasing of a diode, 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, clamping and clipping circuits. Characteristics of a Zener diode.

BJT characteristics and its different regions of operation. Biasing of a BJT. Small signal equivalent circuit models of BJT. Voltage and current gain, input and output impedance of common base, common emitter and common collector amplifier circuits.

Structure and physical operation of an enhancement MOSFET.

Properties of ideal OP-Amps, non-inverting and inverting amplifiers, inverting integrators, differentiator, weighted summer and other applications of Op-Amp circuits. Comparator circuit with Op-Amps.

Number system and codes. Boolean algebra, De Morgan's law. Diode logic gates, transistor switches, transistor-transistor gates, MOS gates. Logic Families: TTL, ECL, IIL and CMOS logic with operation details. Decoders and encoders, multiplexers and combinational circuit design. Different types of latches, flip-flops. A/D and D/A converters with applications.

Timing circuit using 555 Timer IC. Monostable and astable multivibrators.

EEE 2286   Introduction to Analog and Digital Electronics
                            Sessional
1.5 Credits, 3 hours/week

Sessional works compatible to EEE 2285.

Chapter 8 — Equivalence of Old courses with New Courses

8.1   Equivalence of EEE Courses

Course(s) of Old Syllabus		Course(s) of New Syllabus	
EEE 2207	Electromagnetics	EEE 3117	Electromagnetics
EEE 3105	Power System I	EEE 3205	Power System I
EEE 3106	Power System I Lab	EEE 4154	Power System II Lab
EEE 3251	Power System II	EEE 4153	Power System II
EEE 4257	High Voltage Engineering	EEE 4157	High Voltage Engineering
EEE 4258	High Voltage Engineering Lab.	EEE 4158	High Voltage Engineering Lab.
EEE 4103	Solid State Devices	EEE 3203	Solid State Devices
EEE 4153	Power Electronics	EEE 4227	Power Electronics
EEE 4154	Power Electronics Lab	EEE 4228	Power Electronics Lab
EEE 3271	Random Signals and Processes	EEE 4177	Random Signals and Processes
EEE 3231	Digital Electronics II	EEE 4137	Digital Electronics II
EEE 4223	Biomedical Instrumentation	EEE 4237	Biomedical Instrumentation
EEE 4224	Biomedical Instrumentation Lab.	EEE 4238	Biomedical Instrumentation Lab.
EEE 4237	Semiconductor Device Theory	EEE 4239	Semiconductor Device Theory

8.2   Equivalence of Non-Departmental Courses

Course of Old Syllabus		Course of New Syllabus	
HUM 3209	Industrial Management	HUM 3109	Industrial Management
HUM 3109	Accounting and Economics	HUM 2209	Accounting and Economics
CSE 4191 &	Multimedia Communications I &	CSE 4295	Multimedia Communications
CSE 4295	Multimedia Communications II		

8.3   New Courses offered by the Department of EEE

Course No.	Course Title
EEE 4138	Digital Electronics II Lab
EEE 4178	Random Signals and Processes Lab
HUM 4229	Society, Ethics and Technology (SET)

8.4   New Courses offered by the Department of EEE for Department of MPE

Course No.	Course Title
EEE 1287	Basic Electrical Engineering
EEE 1288	Basic Electrical Engineering Lab
EEE 2187	Electrical Machines
EEE 2188	Electrical Machines Sessional
EEE 2285	Introduction to Analog and Digital Electronics
EEE 2286	Introduction to Analog and Digital Electronics Sessional

8.5 Course(s) omitted by the Department of CSE

Course No.	Course Title
EEE 2241	Electrical Drives and Instrumentation
EEE 2242	Electrical Drives and Instrumentation Lab.

Chapter 9   **List of Reference Books for EEE Courses**

EEE 1101 Electrical Circuits I

1. "Electric Circuits", James W. Nilsson, Susan Riedel - Addison-Wesley.
2. "Introduction to Electric Circuits", Richard C. Dorf, James A. Svoboda - John Wiley & Sons, Inc.
3. "Basic Engineering Circuit Analysis", J. D. Irwin - MacMillan.
4. "Introductory Circuit Analysis", Robert .L. Boylestad - Pearson.
5. "Fundamental of Electric Circuits", Charls K. Alexander and Matthew N. O. Sadiku - Tata-McGraw-Hill.

EEE 1201 Electrical Circuits II

1. "Alternating Current Circuits", R. M. Kerchner and G. F. Corcoran - Wiley International Edition.
2. "Electric Circuits", James W. Nilsson, Susan Riedel - Addison-Wesley.
3. "Introduction to Electric Circuits", Richard C. Dorf, James A. Svoboda - John Wiley & Sons Inc.
4. "Introductory Circuit Analysis", Robert .L. Boylestad - Pearson.
5. "Fundamental of Electric Circuits", Charls K. Alexander and Matthew N. O. Sadiku - Tata-McGraw-Hill.

EEE 2103 Electronics I

1. "Microelectronic Circuits", Adel S. Sedra, Kenneth Carless Smith - Oxford University Press.
2. "Microelectronic Circuits and Devices", Mark N. Horenstein - Prentice Hall International Inc.
3. "Electonic Devices and Circuits", David A. Bell - Prentice Hall International Inc.

4. "Electronic Devices and Circuit Theory", R. Boylestad and L. Nashelsky - Prentice Hall.
5. "The Art of Electronics", P. Horowitz and W. Hill - Cambridge University Press.
6. "Electronic Principles", A. P. Malvino - Tata McGraw-Hill.
7. "Electronics Fundamentals: Circuits, Devices, and Applications", Thomas L. Floyd - Prentice Hall.
8. "Theory and Problems of Electronic Device and Circuit", Jimmie J. Cathey, Schaum's Outline Series - McGraw-Hill.
9. "Analysis and Design of Analog Integrated Circuits", Paul R. Gray, Paul J. Hurst and Stephen H. Lewis, John Wiley & Sons Inc.
10. "Electronic Circuit Analysis and Design", Donald A. Neamen, Tata McGraw-Hill.

EEE 2105   Energy Conversion I

1. "Electric Machinery Fundamentals", Stephen J. Chamman - McGraw-Hill International Edition.
2. "Electric Machines: Theory, Operating Applications, and Controls", Charles I. Hubert - Pearson.
3. "Direct and Alternating Current Machinery", Jack Rosenblatt, M. Harold Friedman - Charles E. Merrill Publishing International.
4. "Alternating Current Machines", A. F. Puchstein, T. C. Lloyd and A. G. Conrad - John Wiley & Sons Inc.
5. "Electric Machinery and Transformers", Irving L. Kosow Alternating Current Machines", A. F. Puchstein - Prentice Hall.

EEE 2109   Programming Language

1. "Programming with C++", J. R. Hubbar, Schaum's Outline Series - McGraw-Hill.

2. "The C++ Programming Language", Bjarne Stroustrup - Pearson Education.
3. "C++ How to Program", H. M. Deitel, P. J. Deitel - Prentice Hall.
4. "Teach Yourself C++", H. Schildt, Osborne - McGraw-Hill.
5. "Advanced Programming in C", H. Schildt - McGraw-Hill.

EEE 2203   Electronics II

1. "Microelectronics", Jacob Millman and Arvin Grabel - McGraw-Hill Publishing Company Ltd.
2. "Operational Amplifiers and Linear Integrated Circuits", R. F. Coughlin and Frederick F. Driscoll - Prentice Hall.
3. "Microelectronic Circuits", Adel S. Sedra, Kenneth Carless Smith - Oxford University Press.
4. "Electronic Communication Systems", Kennedy - Tata McGraw-Hill Education.
5. "Operational Amplifiers with Linear Integrated Circuits", W. Stanley - CBS Publishers and Distributors.
6. "Microelectronic Circuits and Devices", Mark N. Horenstein - Prentice Hall International Inc.

EEE 2205   Energy Conversion II

1. "Electric Machinery Fundamentals", Stephen J. Chamman - McGraw-Hill International Edition.
2. "Direct & Alternating Current Machinery", Jack Rosenblat and M. Harold Friedman - Charles E. Merrill Publishing International.
3. "Alternating Current Machines", A. F. Puchstein, T. C. Lloyd and A. G. Conrad - John Wiley & Sons Inc.
4. "Electric Machinery and Transformers", Irving L. Kosow - Prentice-Hall.
5. "Electrical Machinery", A. E. Fitzgerald, C. Kingsley and S. D. Umans - Tata McGraw-Hill.

EEE 2211   Measurement and Instrumentation

1. "A Course in Electrical and Electronics Measurement and Instrumentation", A. K. Sawhney - Dhampat Rai & Co.
2. "Modern Electronic Instrumentation and Measurement Techniques", A. D. Helfrick, W. D. Cooper - Prentice Hall.
3. "Transducers and Instrumentation", D. V. S. Murty - Prentice Hall.
4. "Electronic Instruments and Instrumentation Technology., M. M. S. Anand - Prentice Hall.
5. "Operational Amplifiers and Linear Integrated Circuits", R. F. Coughlin and Frederick F. Driscoll - Prentice Hall.
6. "Elements of Electronic Instrumentation and Measurements", Joseph J. Carr - Prentice Hall.

EEE 3103   Digital Electronics I

1. "Digital Logic and Computer Design", M. Morris Mano - Prentice Hall.
2. "Digital Design Principles and Practices", J. F. Wakerly - Prentice Hall.
3. "Digital Fundamentals", T. L. Floyd - Prentice Hall International Inc.
4. "Digital Systems- Principles and Applications", Ronald J. Tocci and Neal S. Widmer - Prentice Hall International Inc.
5. "Digital Integrated Electronics", Herbert Taub and Donald Schilling - Mcgraw-Hill.

EEE 3107   Signals and Linear Systems

1. "Signal Processing & Linear Systems", B.P. Lathi - Oxford University Press.
2. "Continuous and Discrete Signals and Systems", Samir S. Soliman and D. Srinath - Prentice Hall.
3. "The Analysis of Linear Systems", David K. Cheng - Addison-Wesley.

4. "Signals and Systems", A V. Oppenheim, Alan S. Willsky, S. Hamid Nawab - Prentice Hall.
5. "Signals, Systems and Transforms", Charles L. Phillips, John M. Parr, Eve A. Riskin - Prentice Hall International Inc.
6. "Signals and Systems with MATLAB Applications", Steven T. Karris - Orchard Publications.

EEE 3113   Electrical Properties of Materials

1. "Principles of Electronic Materials and Devices", S. O. Kasap - McGraw- Hill.
2. "Electrical Engineering Materials", A. J. Dekker - Prentice Hall.
3. "Perspectives of Modern Physics", A. Beiser - McGraw-Hill.
4. "Solid State Electronic Devices:International Edition", Ben Streetman, Sanjay Banerjee - Prentice Hall.
5. "Electronic Properties of Materials", Rolf E. Hummel - Springer.

EEE 3117   Electromagnetics

1. "Fundamentals of Engineering Electromagnetics", David K. Cheng - Addison-Wesley.
2. "Elements of Electromagnetices", Matthew N. O. Sadiku - Oxford University Press.
3. "Engineering Electromagnetics", William Hart Hayt, John A. Buck - MCGRAW-HILL Higher Education.
4. "Fundamentals of Applied Electromagnetics", Fawwaz T. Ulaby, Eric Michielssen, Umberto Ravaiol - Pearson.
5. "Fields and Waves in Communication Electronics", S. Ramo, J. R. Whinnery and T. Vanduzer - John Wiley and Sons.
6. "Field and Wave Electromagnetics", D. K. Cheng - Addison Wesley.
7. "Elements of Engineering Electromagnetics", Nannapaneni Narayana Rao - Prentice Hall.

EEE 3203   Solid State Devices

1. "Semiconductor Devices", M. J. Cooke - Prentice Hall.
2. "Solid State Electronic Devices", Ben Garland Streetman, Sanjay Kumar Banerjee - Prentice Hall.
3. "Fundamentals of Solid State Electronics", Chih-Tang Sah - World Scientific.
4. "Principles of Electronic Materials and Devices", Safa O. Kasap - McGraw-Hill Education.
5. "Physics of Semiconductor Devices", Michael Shur - Prentice Hall.
6. "Concepts of Material Physics", Arthur Beiser - McGraw-Hill.
7. "Semiconductor Physics and Devices", Donald A. Neamen - Tata McGraw-Hill.
8. "Semiconductor Device Fundamentals", Robert F. Pierret - Pearson.
9. "Physics of Semiconductor Devices", S. M. Sze and Kwok K. Ng - John Wiley & Sons Inc.

EEE 3205   Power System I

1. "Elements of Power System Analysis", William D. Stevenson - McGraw-Hill.
2. "Principles of Power System", V. K. Mehta - S. Chand and Company Ltd.
3. "Power System Analysis and Design", B. R. Gupta – A. H. Wheeler Publishing Company Limited.
4. "Modern Power System Analysis", I. J. Nagrath and D. P. Kothari - Tata McGraw-Hill Publishing Company Limited.
5. "Electrical Power Systems", C. L. Wadhwa - New Age International.
6. "Power System Analysis", Hadi Saadat - PSA Publishing.
7. "Power Systems Analysis and design", J. Duncan Glover, Mulukutla Sarma, Thomas Overbye - Cengage Learning.

EEE 3207   Communication Theory

1. "Communication Systems", S. Haykin - John Wiley and Sons.
2. "Information Transmission, Modulation, and Noise: A Unified Approach to Communication Systems", M. Schwartz - McGraw-Hill.
3. "Digital Telephony", J. Bellemy - John Wiley and Sons.
4. "Electronic Communication", S. Gupta - Khanna.
5. "Modern Digital and Analog Communication System", Bhagwandas Pannalal Lathi, Zhi Ding - Oxford University Press.
6. "Electronic Communications Systems: Fundamentals Through Advanced", W. Tomassi - Prentice Hall Career & Technology.

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2. "Elements of Electrical Power Station Design", M. V. Deshpande - PHI Learning Pvt. Ltd.

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