Syllabus for Undergraduate Studies

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Rajshahi University of Engineering & Technology

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PREFACE

Sagor Chandro Bakchy
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It is an immense pleasure to introduce the first edition of the *Syllabus for Undergraduate Study* of the Department of Electrical and Computer Engineering. This booklet presents the course study and research program of the Department of ECE. A list of faculty members and detailed outline of courses offered by the department are included here with this booklet.

Electrical & Computer Engineering, which applies technical skills of the creation and operation of Electrical & Computer Engineering systems, is a broad-based discipline. The Electrical & Computer Engineering Department at Rajshahi University of Engineering & Technology (RUET) offers an undergraduate (Bachelor of Science in Engineering) program. This is a four-year program that prepares the students to enter the professional practice of various Electrical & Computer Engineering fields or to continue advanced study leading to M.Sc. Engg. or M. Engg. and Ph.D. degree.

The rules and regulations shown in this booklet may be changed or modified as and when necessary. This booklet will help the concerned students as well as the Student Advisors of the Electrical & Computer Engineering department.

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Rajshahi University of Engineering & Technology

Rajshahi
September 2023

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Chapter I
General Information

1. The University

Rajshahi University of Engineering & Technology is the second oldest university for the study of Engineering in Bangladesh. In order to create facilities for undergraduate and postgraduate studies and research, the Engineering College, Rajshahi established in 1964 was converted to BIT, Rajshahi in the year 1986 and the BIT, Rajshahi was upgraded to Rajshahi University of Engineering & Technology (RUET) in 2003. With a view to meeting the increasing demand for engineers in the country and to expand the facilities for advancement of Engineering education, Engineering College, Rajshahi started functioning as a Faculty of Engineering under the University of Rajshahi offering four years Bachelor Degree in Civil, Electrical and Mechanical Engineering. Starting with 122 undergraduate students, the university now has about 6000 undergraduate and around 600 postgraduate students.

2. Location of the University

RUET campus spreading over 152 acres of land, is located about 3 kilometers east of Rajshahi city by the side of the mighty river the Padma and very adjacent to the University of Rajshahi. The Rajshahi city is well connected by road and rail with other towns and cities of Bangladesh. Rickshaws, human hauler, taxi and bus facilities are available to reach the campus from any place in the city.

3. The Campus

RUET has a compact campus with departments, laboratories, workshops, library, auditorium, gymnasium, central common room, residence halls (for male and female students) and residential buildings for teachers and employees within walking distances from the academic building. One bank and one post-office are also located in the campus. There is a school cum college in the campus in view of delivering proper education for the children of employees. A general store and a restaurant are also situated very near to the student halls. The varieties of plants and trees give a pleasant and natural environment in the campus.

4. Facilities Offered by the University

4.1 Central Library

The central library building is located at the central part of the university campus. As an integral component of the academic program, the central library provides the following services to the teachers, students and staffs.

i) Issue and receipt of books

ii) Reading room facility
iii) Periodicals and Journal section.

4.2 Central Computer Center

The central computer center provides computer and internet support to undergraduate and postgraduate study and research for all the faculties and students of all Departments. This center possesses networking facilities with modern computers. This center also provides useful software like C, C++, Visual Fox Pro, Oracle, Auto CAD UNIX/ Linux, MS-DOS, MS-WORD, Excel and many more. The central computer center also has an area with a mural of the Nation's Father Bangabandhu Sheikh Mujibur Rahman named "Bangabandhu Corner". This corner provides contents about Bangabandhu Sheikh Mujibur Rahman and the Liberation War of Bangladesh, 1971.

4.3 Medical Center

An on campus medical center provides primary health care facilities to the students (residential and non-residential) free of charge. Full-time MBBS doctors, compounder and staffs provide these facilities to the students. For specialized consultation on complicated cases, the center refers the patients to specialist consultants. A psychiatrist is also available for mental consultation to the students.

4.4 Directorate of Student's Welfare

The Directorate of Student's Welfare is responsible for the various activities related to the physical, social, cultural and other aspects of the welfare of the students. These include an arrangement of supervision for halls of residence, programs for physical education, games and sports, cultural weeks and other activities of the students through the central student's union and the student's unions of the various halls of residence. The central student's union, whose members are elected by the students, oversees the socio-cultural activities of the students and looks after the problems of the students. The student's unions of the various halls of residence also arrange their individual socio-cultural activities, literary competitions etc., and help the hall authority to run the halls smoothly.

4.5 Sports and Recreation Facilities

The athletic club of the university provides multi-purpose sports facilities to the students to acquire physical fitness indispensable for a healthy mind and body. The University has a beautiful playground for football, cricket, badminton, volleyball, tennis and others. A gymnasium within the University plays an important role in

building up the health of the students. Indoor facilities are also available in the gymnasium building. The athletic club arranges gorgeous annual sports every year. Parallel to the University, departments and students' unions of the various halls of residence also arrange inter-class and inter-department football, cricket, basketball, and volleyball competitions every year.

4.6 Residential Accommodation

Campus life is an important aspect in the development of students. In addition to providing services in assisting students in solving problems that affect their studies, the university aims to create an environment conducive to cultural development and promotion of interaction among staff, students and intellectuals. The university has seven halls of residence for the accommodations of the students. The total capacity of the residence halls is around 2100. Name of the halls with their capacities is listed below. Three halls are named after the national heroes who were the students of this university and sacrificed their lives in 1971 in the liberation war of Bangladesh.

Sl. No.	Halls of Residence	Capacity
1	Shahid Lt. Selim Hall	350
2	Shahid Shahidul Islam Hall	225
3	Shahid Abdul Hamid Hall	225
4	Tin Shed Hall (Extension)	100
5	Deshratna Sheikh Hasina Hall	250
6	Shahid President Ziaur Rahman Hall	450
7	Bangabandhu Sheikh Mujibur Rahman Hall	450

4.7 Facilities Offered by the Electrical & Computer Engineering Department

The Department of ECE has a number of facilities to meet up the requirements of undergraduate study. These facilities include a rental library and different world class laboratories. To date, the department possesses the following well-equipped laboratories for research and sessional classes.

1. Electrical Laboratories
2. Electronic Laboratories
3. Computer Laboratories
4. Software Laboratories
5. Peripheral and Interfacing Laboratories

6. Energy Conversion Laboratories
7. Robotics Laboratories
8. Artificial Intelligence Laboratories
9. VLSI Laboratories

Chapter II
Academic Ordinance for the Undergraduate Studies

1. Definitions

1.1 'University' means the Rajshahi University of Engineering & Technology abbreviated as RUET.

1.2 'Syndicate' means Syndicate of RUET.

1.3 'Academic Council' means the Academic Council of the University.

1.4 'Deans Committee' means the Executive Committee of concerned Faculty of the University.

1.5 'Academic Committee' means the Academic Committee for Undergraduate Studies of Department of the University.

1.6 'Vice-Chancellor' means the Vice-Chancellor of the University.

1.7 'Dean' means the Dean of the Faculty of the University.

1.8 'Head of the Department' means the Head of a Department of the University.

1.9 'Central Equivalence Committee' means the Central Equivalence Committee of the University.

1.10 'Degree' means the degree of Bachelor of Science in Engineering or Bachelor of Urban & Regional Planning or Bachelor of Architecture offered by the University.

1.11 'Course System' means pass or fail on course basis.

1.12 'Backlog Courses' means the failed courses after appearing at odd/even semester(s) examination.

1.13 'Short Semester' means a semester for conducting classes and examinations of Backlog course(s) at the end of 4^{th} /5^{th} year Backlog examination result.

2. Faculties

The University has four Faculties:

1) Faculty of Civil Engineering (CE)
2) Faculty of Electrical & Computer Engineering (ECE)
3) Faculty of Mechanical Engineering (ME)
4) Faculty of Applied Science & Humanities (ASH)

2.1 Degree Awarding Departments

The University has the following Degree Awarding Departments under four Faculties:

i) Department of Civil Engineering (CE)
ii) Department of Electrical & Electronic Engineering (EEE)

iii) Department of Mechanical Engineering (ME)
iv) Department of Computer Science & Engineering (CSE)
v) Department of Electronic and Telecommunication Engineering (ETE)
vi) Department of Industrial and Production Engineering (IPE)
vii) Department of Glass & Ceramic Engineering (GCE)
viii) Department of Urban & Regional Planning (URP)
ix) Department of Mechatronics Engineering (MTE)
x) Department of Architecture (ARCH)
xi) Department of Electrical & Computer Engineering (ECE)
xii) Department of Chemical & Food Process Engineering (CFPE)
xiii) Department of Materials Science & Engineering (MSE)
xiv) Department of Building Engineering & Construction Management (BECM)
xv) Any other Department to be instituted by the Syndicate on the recommendation of the Academic Council.

2.2 Teaching Departments

The University has the following teaching departments as defined in the statutes:

i) Department of Civil Engineering
ii) Department of Electrical & Electronic Engineering
iii) Department of Mechanical Engineering
iv) Department of Computer Science & Engineering
v) Department of Electronic and Telecommunication Engineering
vi) Department of Industrial and Production Engineering
vii) Department of Glass & Ceramic Engineering
viii) Department of Urban & Regional Planning
ix) Department of Mechatronics Engineering
x) Department of Architecture
xi) Department of Electrical & Computer Engineering
xii) Department of Chemical & Food Process Engineering
xiii) Department of Materials Science & Engineering
xiv) Department of Building Engineering & Construction Management
xv) Department of Mathematics
xvi) Department of Physics
xvii) Department of Chemistry
xviii) Department of Humanities
xix) Any other Department to be instituted by the Syndicate on the recommendation of the Academic Council.

3. Degrees Offered

The University offers courses leading to the award of the following degrees:

i) Bachelor of Science in Civil Engineering abbreviated as B.Sc. Engg. (CE)
ii) Bachelor of Science in Electrical & Electronic Engineering abbreviated as B.Sc. Engg. (EEE)
iii) Bachelor of Science in Mechanical Engineering abbreviated as B.Sc. Engg. (ME)
iv) Bachelor of Science in Computer Science & Engineering abbreviated as B.Sc. Engg. (CSE)
v) Bachelor of Science in Electronics & Telecommunication Engineering abbreviated as B.Sc. Engg. (ETE)
vi) Bachelor of Science in Industrial and Production Engineering abbreviated as B.Sc. Engg. (IPE)
vii) Bachelor of Science in Glass & Ceramic Engineering abbreviated as B.Sc. Engg. (GCE)
viii) Bachelor in Urban & Regional Planning abbreviated as BURP.
ix) Bachelor of Science in Mechatronics Engineering abbreviated as B.Sc. Engg. (MTE)
x) Bachelor in Architecture abbreviated as B. ARCH.
xi) Bachelor of Science in Electrical & Computer Engineering abbreviated as B.Sc. Engg. (ECE)
xii) Bachelor of Science in Chemical & Food Process Engineering abbreviated as B.Sc. Engg. (CFPE)
xiii) Bachelor of Science in Materials Science & Engineering abbreviated as B.Sc. Engg. (MSE)
xiv) Bachelor of Science in Building Engineering & Construction Management abbreviated as B.Sc. Engg. (BECM)

Any other degree that may be awarded by any department on the approval of the syndicate on the recommendation of the Academic council.

4. Student Admission, Equivalence and Admission Transfer

4.1 The four academic years of study for the Bachelor degree have been designated as 1st year class, 2nd year class, 3rd year class and 4th year class in succeeding higher levels of study. For Architecture, five years of study for the Bachelor degree have been designated as 1st year class, 2nd year class, 3rd year class, 4th year class and 5th year class in succeeding higher levels of study.

4.2 Students shall be admitted into the 1st year class.

4.3 The Academic Council will form an Admission Committee in each academic session for admission into 1st year Bachelor Degree class.

4.4 A candidate for admission into the 1st year class must have passed the H.S.C Examination from a Secondary and Higher Secondary Education Board in Bangladesh (after 12 years of schooling) with Physics, Chemistry, Mathematics and English as his/her subjects of Examination in Higher Secondary level or examination recognized as equivalent thereto, and must also fulfill all other requirements as prescribed by the Academic Council on the recommendation of the Admission Committee. In case of confusion regarding the equivalence, the case may be referred to Equivalence Committee.

4.5 All candidates for admission into the courses of Bachelor Degree must be the citizens of Bangladesh. Candidates for all seats except the reserved (Tribal) ones, if any, are selected on the basis of merit. However, all candidates must pass the required level as set by the admission committee. The Academic Council, on the recommendation of the Admission Committee, frames the rules for admission into the reserved seats.

4.6 No student ordinarily is admitted in the 1st year class after the corresponding classes start or after the call goes out for admission into the next session, whichever is earlier.

4.7 Admission of a newly admitted student in the 1st year class is canceled if he/she fails to attend any class within the first two consecutive cycles after the start of class without prior permission. The date of commencement of classes for the newly admitted students will be announced in advance.

4.8 An Equivalence Committee consisting of at least five members will be formed by the Academic Council in order to consider the equivalence of different public examinations.

4.9 A candidate, seeking admission on transfer from other University, should apply to the Registrar of the University if there is any exchange program with that university. The Registrar will refer the case to the concerned Head of the Department and also to the Equivalence Committee. On receiving the opinions of the Head of the Department and of the Equivalence Committee, the matter will be forwarded to the Academic Council. The Academic Council's decision will be communicated to the Head of the Department and the candidate.

4.10 There is no transfer in the 1st year class. In special cases, students may be admitted into a higher class under clause 4.8.

4.11 Every student being admitted to the University shall be examined by a competent medical officer as prescribed in the admission rules.

5. Method of Course Offering and Instruction

The undergraduate curricula at RUET are based on course system. The salient features of course system is:

i) Number of theoretical courses and examination papers shall be five in each semester (except for architecture and URP).

ii) Continuous evaluation of student's performance.

iii) The flexibility to allow the student to progress at his/her own pace depending on his/her ability or convenience, subject to the regulations on credit and minimum grade point average (GPA) requirements.

iv) Promotion of teacher-student contact.

6. Academic Calendar

6.1 The academic year is ordinarily divided into two semesters each having duration of not less than 13 weeks.

6.2 There are final examinations at the end of each semester conducted by the respective degree awarding departments of the University.

6.3 On the approval of the Academic Council an academic schedule for the year will be announced for general notification before the start of the academic year.

The schedule may be prepared according to the following guidelines:

Odd Semester	**Duration**
Classes	13 Weeks
Mid-semester recess	1 week
Recess before examination and Semester Final Examination	29 days
Inter-Semester Recess	1 weeks
Even Semester	**Duration**
Classes	13 Weeks
Mid-semester recess	1 week
Recess before examination and Semester Final Examination	29 days
Inter-Year Recess	1 week

Vacation and others	Rest
Total	52 Weeks
Short Semester	**Duration**
Classes and Examinations	10 weeks

7. Duration of Course and Course Structure

7.1 Bachelor Degree courses (except Architecture) extend over a period of four academic years (8 semesters), each of a normal duration of one calendar year, which is divided as necessary for the purpose of academic program and conduct of examinations. For Bachelor degree in Architecture, the period will be five academic years (10 Semesters).

7.2 The curricula of the Bachelor degree in the different departments are as proposed by the respective Academic and Dean's Committee and approved by the Syndicate on the recommendation of the Academic Council.

7.3 The Academic Committee reviews the curricula as required and put forward suggestions to the Academic Council through Dean's Committee.

7.4 Teaching for the courses is reckoned in credits and the credits allotted to various courses are determined by the Academic Committee with the following guidelines:

Nature of Course	**Contact hour**	**No. of Credit**
i) Theory	1 hour/week	1.00
ii) Tutorial	1 hour/week	1.00
iii) Independent sessional/design	3/2 hours/week 2 hours/week 3 hours/week and similar	0.75 1.00 1.50
iv) Project & thesis	3 hours/week and similar	1.50
v) Field work/ Industrial training	2-4 weeks of field work	1.00-1.50

7.5 The total number of credits that a student has to complete successfully for the award of Bachelor degree is minimum 160 except for Bachelor in

Architecture. The maximum period of candidature is seven years, i.e., 3 years (6 semesters) more than the normal time required to complete the course. For Architecture the minimum credit will be 200.

7.6 The total number of credits per week in a semester shall be as approved curricula.

7.7 The total contact hours for students including lecture, tutorial and sessional is around 25 (35 for Architecture) periods per week, each period being of minimum 50 minutes duration.

7.8 In each degree-awarding department, one of the senior teachers nominated by the Head of the Department acts as Course Coordinator who acts as Member Secretary to the academic committee.

7.9 A course plan for each course, approved by the Course Coordinator, showing details of lectures may be announced at the start of each semester.

7.10 Credits in any theory subject do not exceed 4 and that in sessional subject do not exceed 3.0. For Architecture credits in sessional subject will not exceed 12.0.

8. Course Designation and Numbering System

Details of the course designation and number system are provided in Annexure A.

9. Types of Courses

The courses included in undergraduate curricula are divided into several groups as follows:

9.1 **Core Courses:** In each discipline a number of courses are identified as core courses which form the nucleus of the respective Bachelor's degree program. A student has to complete all of the designated core courses for his discipline.

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

9.3 **Optional Courses:** Apart from the core courses, students have to complete a number of courses which are optional in nature. In those cases, students will have some choices to choose the required number of courses from a specified group/number of courses.

10. Departmental Monitoring Committee and Student Adviser

10.1 **Department monitoring committee:** Each department constitutes a Departmental Monitoring Committee with two teachers from the respective Department as members, nominated by the Academic Committee and Head of the Department as chairman. This committee monitors and evaluates the performance of the Course System within the Department. The committee may also propose from time to time to the Academic Committee if any changes and modifications needed for upgrading/changing the Undergraduate Curriculum and the Course System.

10.2 **Student Adviser:** Advisor(s) are appointed for a batch of student by the Department Monitoring Committee of the concerned Department(s) who advises each student on the courses to be taken by a student. Adviser discusses with the student on his academic program and then decides the nature of courses for which he/she can register. However, it is the student's responsibility to keep contact with his adviser who reviews and eventually approves the student's specific plan of study and checks on subsequent progress. The adviser generally be of the rank of an Assistant Professor or above from the concerned Department(s). However, in case of shortage of teachers, Lecturers may be appointed as adviser.

For a student of second and subsequent semesters, the nature of courses for which he can register will be decided on the basis of his/her academic performance during the previous semester(s). The adviser advises the students to register for the courses during the next semester within the framework of the guidelines in respect of minimum/maximum credit hours limits.

11. Registration Requirements

Any student who wants to study a course is required to register formally. Being admitted to the University, each student is assigned to a student adviser. The student can register for courses he/she intends to take during a given semester only on the basis of the advice and consent of his/her adviser.

11.1 **Registration Procedure:** Students must register for each class in which they will participate. Each student will fill up his/her Course Registration Form in consultation with and under the guidance of his/her adviser. The original copy of the Course Registration Form(s) will be submitted to the Registrar's Office, and then the requisite number of copies will be distributed to the adviser and Head. The date, time and venue for registration will be announced in advance by the Department's Office. It

is absolutely necessary that all students present themselves for registration at the specified time.

11.2 **Limits on the Credit Hours to be taken:** A student must be enrolled for the requisite number of credits as mentioned in article 7.6. A student must enroll for the prescribed sessional courses in the respective semester within the allowed credit limits.

11.3 **Pre-condition for Registration:** A student will be allowed to register in those courses subject to the satisfaction of pre-requisite courses. If a student fails in a pre-requisite course in any semester, the concerned Department Monitoring Committee may allow him/her to register for a course which builds on the pre-requisite course provided his attendance and grades in continuous assessment in the said pre-requisite course is found to be satisfactory.

Registration will be done at the beginning of each semester. Late registration is however, permitted during the second week on payment of a late registration fee. Students having outstanding dues to the University or a hall of residence shall not be permitted to register. All students have therefore, to clear their dues and get a clearance or no dues certificate, on the production of which, they will be given necessary Course Registration Forms and complete the course registration procedure. Registration Forms are normally available in the Register's office. An orientation program will be conducted for only the first-year students at the beginning of the first semester when they will be handed over the registration package on producing enrollment slip/proof of admission.

11.4 **Registration Deadline:** Student must register for the courses to be taken within 1 (One) cycle from the commencement of each semester and no late registration will be accepted after 2(Two) cycles of classes. Late registration after this date will not be accepted unless the student submits a written appeal to the Registrar through the concerned Head and can document extraordinary circumstances such as medical problems (physically incapacitated and not able to be presented) or some other academic commitments which precluded enrolling prior to the last date of registration.

11.5 **Penalty for Late Registration:** Students who fail to register during the designated dates for registration are charged a late registration fee Tk 500/= per cycle. This extra fee will not be waived whatever be the reason for late registration.

11.6 **Withdrawal from a Semester:** If a student is unable to complete the semester Final Examination due to illness, accident or any other valid

reason etc., he/she may apply to the Head of the department. Each Department will decide for total withdrawal from the semester before the start of the semester final examination. He/she may choose not to withdraw any laboratory/sessional/design course if the grade obtained in such a course is 'D' or better. The application must be supported by a medical certificate from any authorized Medical Officer. The Academic Council will take the final decision about such applications. However, he/she will not be permitted to the next year class unless he/she completes the required credit for that year.

12. Striking off the Names and Readmission

12.1 The names of the students shall be struck off and removed from the rolls on the following grounds:

i) Non-payment of University fees and dues within the prescribed period.

ii) Forced to discontinue his/her studies under disciplinary rules.

iii) Withdrawal of names from the rolls of the University on grounds acceptable to the Vice-Chancellor of the University/ nominated authority after having cleared all dues.

iv) Could not earn required credits for graduation as outlined in the respective curriculum and/or fulfill CGPA requirement within the maximum allowed time of 7 academic years. For Architecture maximum allowed time is 8 academic years.

12.2 Every student whose name has been struck off the rolls by exercise of the clauses (ii) of Article 12.1 seeking re-admission after expiry of the period for which he/she was forced to discontinue his/her studies, shall submit an application to the Head of the Department in the prescribed form before the commencement of the session to which he/she seeks re-admission. The Head of the Department shall forward the application to the Registrar of the University with his remarks. In case the readmission is allowed, the student will be required on payment of all dues to get him/her-self admitted no later than one week from the date of permission given by the Registrar. All readmission should preferably be completed before the session starts. The percentage of attendance of the re-admitted students shall be counted from the date of recommendation of the concerned Head of the department.

12.3 No student who has withdrawn his/her name under clause (iii) of Article 12.1 shall be given readmission.

12.4 In case, a student whose name has been struck off the rolls under clause (i) of Article 12.1 seeks readmission within the session in which his/her name was struck off, he/she shall be readmitted on payment of all the arrears fees and dues. But if he/she seeks readmission in any subsequent session, the procedure for his/her readmission will be the same as described under Article 12.2.

12.5 The application of a student for readmission will be considered if he/she applies within two academic sessions from the semester of discontinuance of his/her studies in the University. Other than debarment as punishment under the ordinance related to discipline, a student failing for any other reason whatsoever to become a candidate for a semester final examination in which he/she ought to have had in the usual process of his/her progressive academic activities, shall be considered to have discontinued his/her studies for the relevant semester together with striking the name off from current roll and two such discontinuance periods will be considered equivalent to that for one academic session. The maximum period of discontinuance under no circumstances is to exceed two academic sessions during a student's period of studies for the degree.

12.6 In case any application for readmission is rejected, the student may appeal to the Academic Council and, in this case, the decision of the Academic Council shall be final.

12.7 A student, whose name has been struck off the rolls by exercise of clause (iv) of Article 12.1, is not eligible to seek readmission.

12.8 After Short semester, if any student fails to complete his/her required courses he/she will take readmission in the final year.

13. Grading System

The letter grade system shall be used to assess the performance of the student and shall be as follows:

Numerical grade	Letter grade	Grade point
80% or above	A+ (A Plus)	4.00
75% to less than 80%	A (A Regular)	3.75
70% to less than 75%	A- (A Minus)	3.50
65% to less than 70%	B+ (B Plus)	3.25
60% to less than 65%	B (B Regular)	3.00
55% to less than 60%	B- (B Minus)	2.75
50% to less than 55%	C+ (C Plus)	2.50
45% to less than 50%	C (C Regular)	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00
Incomplete	I	-
Need to register again	--	-

A grade 'I' shall be awarded for courses (like project & thesis, design etc.) in the odd semester, which continue through to the even semester.

13.1**Calculation of GPA and CGPA**

Grade point average (GPA) is the weighted average of the grade points obtained in all the courses passed/completed by a student in a semester. 'F' grades do not count for GPA calculation. GPA of a semester will be calculated as follows:

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

Where, n is the total number of courses passed by the student, C_i is the number of credits allotted to a particular course i and G_i is the grade point corresponding to the grade awarded for i-th course.

The overall or Cumulative Grade Point Average (CGPA) gives the cumulative performance of the student from first semester up to any other semester to which it refers and is computed by dividing the total grade points ($\Sigma C_i G_i$) accumulated up to the date by the total credit hours (ΣC_i). Both GPA and CGPA are rounded off to the second place of decimal for reporting.

14. Distribution of Marks

14.1 **The distribution of marks for a given course is as follows:**

i) Theory courses:

Continuous assessment (40%)
Summative assessment (60%)

Class participation and attendance	10
Class tests	20
Assignment/Project/Viva voce/ Presentation/others	10
Semester Final Examination (3 hours duration)	60
	Total = 100

***** Minimum requirement to pass in the theory course is 15 marks out of 60 in the semester final exam.**

ii) Independent sessional/design/field work courses:

Class participation and attendance	10
Quizzes	20
Lab Performance, Lab Report, Lab Final, Presentation/Viva and Others.	45
Board Viva (Compulsory)	25
	Total = 100

iii) Project and thesis (Architecture):

Class participation and attendance	10
Internal criticisms	40
Viva voce/ Jury	30
Supervisor (Internal Examiner)	20
	Total = 100

iv) Project and thesis (Other departments):

Viva voce (conducted by a viva voce committee)	30
Supervisor (internal examiner)	50
External examiner (any other teacher of the department/ Examination committee)	20
	Total = 100

14.2 Basis for awarding marks for class participation and attendance will be as follows:

Attendance	Marks
90% and above	10
85% to less than 90%	9
80% to less than 85%	8
75% to less than 80%	7
70% to less than 75%	6
65% to less than 70%	5
60% to less than 65%	4
Less than 60%	0

14.3 The students will not be allowed to sit in the semester final examination for failing to attend at least 50% in the classes. The students whose percentage of attendance will fall short of 75% in any of the theory, sessional courses for which he/she has registered in one academic year shall not be eligible for the award of any type of scholarship/stipend/grant for the following academic session.

15. Class tests

i) 3 best out of 4 class tests may be taken for awarding grade.

ii) Duration of class tests normally should be 20-30 minutes and materials covered should be what were taught in 2 to 3 previous cycles or most recent classes.

iii) The dates for the class tests shall be fixed by the Head or Course Coordinator and dates shall be announced accordingly.

iv) All class tests shall ordinarily be of equal value. The result of each individual class test shall be posted for information of the students preferably before the next class test is held.

16. Earned Credits

The courses in which a student has obtained ‘D’ or a higher Grade will be counted as credits earned by him/her. Any course in which a student has obtained ‘F’ grade will not be counted towards his/her earned credits. A student, who obtains a ‘F’ grade in any Core Course in any semester, he/she will have to repeat the course. If a student obtains a ‘F’ in an Optional Course, he/she may choose to repeat the course or take a substitute course if available.

'F' grades will be considered as backlog courses. 'F' grades will not be counted for GPA calculation but will stay permanently on the Grade Sheet and Transcript.
A student obtaining D grade in a course will be allowed to repeat the course for the purpose of grade improvement if CGPA of the student falls below **2.20**. In such case he/she will be awarded the new grade thus he/she obtains or retains his/her previous grade if he/she fails.

17. Performance Evaluation

i) The minimum CGPA requirement for obtaining a B.Sc. Engineering/ Bachelor degree is **2.20**. The performance of a student will be evaluated in terms of two indices, viz. Semester grade point average and cumulative grade point average.

ii) Students will be allowed to sit in Backlog examination for maximum 3 courses (in same year) in an academic year. However only 4th year students are allowed to choose 3 courses from his/her Backlog course(s).

iii) Students must complete minimum 33 credits (Odd, Even semesters and Backlog examination) in each academic year for promotion to the next academic year.

18. Honors, VC's List and University gold medal

18.1 **Honors:** Candidates for Bachelor's degree will be awarded the degree with honors if their CGPA is 3.75 or above and will be called as First Class with Honors.

18.2 **Class:** Candidates having CGPA 3.00 or above and less than 3.75 will be called as First Class and Candidates having CGPA **2.20** or above and less than 3.00 will be called as Second Class.

18.3 **VC's List:** In recognition of excellent performance, the names of students who maintain good standing with the University obtaining SGPA of 3.75 or above in two regular semesters in each academic year may be published in the VC's List in each department. Students who have received F grade in any course during any of the two regular semesters will not be considered for VC's List in that year.

18.4 **University Gold Medal**

If a student can show extraordinary brilliance and obtains all A or better grades in all the courses he/she attended and fulfills the credit requirement for graduation will be honored by awarding University gold medal in a special function/convocation.

19. Student Classification

The regular students are classified according to the number of credit hours earned towards a degree shown in the following table:

Year	Earned Credits
First Year	0 to 33
Second Year	34 to 66
Third Year	67 to 99
Fourth Year	100 and above/ For Architecture 100 to 132
Fifth Year (Architecture)	133 and above (Arch)

20. Registration for the Second & Subsequent Semesters

A student is normally required to register courses according to the approved curricula in each semester. After odd semester final examination, Students will normally register courses in even semester.

21. Measures for Helping Academically weak Students

The following provisions are made in order to help academically weak students to enable them to complete their studies within the maximum period of seven years. Adviser will keep special contact for all such students whose Cumulative grade point average (CGPA) is less than **2.20** at the end of a semester.

22. Backlog Examination

i) There will be Backlog Examination after the publication of result of Even semester examination.

ii) 'F' grade (s) obtained after semester examination will be considered as backlog course (s).

iii) Students are allowed to sit for maximum 3 backlog courses in odd and/or even semester (s).

iv) Class test marks of Backlog courses in odd/even semester(s) will be counted for Backlog examination.

v) Maximum B (B regular) grade will be counted in Backlog examination.

Backlog Courses: The course(s) which a student registered in a Semester but after Semester examination he/she obtained 'F' grade in that course(s).

23. Short Semester Examination

The Short Semester Examination on only backlog courses may be conducted for the students who have participated in their 4(four)/5(Five) year degree course (up to 4^{th} /5^{th} year backlog examination). A student can register maximum 5 (Five) incomplete courses including sessional, project and thesis to obtain Bachelor degree. The short semester examination will be arranged in a convenient time by the Head of the Department within 10 weeks of the publication of results of the final year backlog examination. The evaluation system will be the similar as regular semester. The students willing to appear at the short semester examination have to apply to the Head of the Department and with his permission must register within 15 (Fifteen) working days of publication of final year Backlog examination results. **Maximum grade B** will be counted in short semester examination.

24. Minimum Earned Credit and GPA Requirements for Obtaining Degree

Minimum credit requirements for the award of Bachelor Degree will be recommended by the respective Academic Committee to the Academic Council. The minimum CGPA requirements for obtaining a Bachelor Degree are 2.20.

25. Time Limits for Completion of Bachelor's Degree

A student must complete his/her studies within a maximum period of seven years for 4-year bachelor degree and eight years for 5-year bachelor degree.

26. Industrial/Professional Training Requirements

Depending on each Department's own requirement a student may have to complete a prescribed number of days for industrial/professional training as mentioned in the course curricula.

27. Application for Graduation and Award of Degree

A student who has fulfilled all the academic requirements for bachelor's degree will have to apply to the Registrar/VC through his/her Adviser for graduation. Provisional degree will be awarded on completion of Credit and GPA requirements. Such provisional degrees will be confirmed by the academic council.

28. Inclusion of repeaters from the present system to the new course system

Repeater students will be included in the course system of curricula as and when such situation will arise. Equivalence of Courses and Grades (if required)

will be done by Academic Council with recommendation by the respective Academic and Dean Committee.

29. Absence during Semester

A student should not be absent from quizzes, tests etc. during the semester. Such absence will naturally lead to reduction in points/marks, which count towards the final grade. Absence in semester final examination due to lack of attendance (less than 50%) only of any courses will be considered as unregistered, hence requires a new registration with a regular semester.

A student who has been absent for short period, up to a maximum of three weeks due to illness, should approach the course teacher(s) or the course coordinator(s) for a make-up quizzes or assignments immediately on returning to the classes. Such request should be supported by medical certificate from University medical officer. The medical certificate issued by a registered medical practitioner (with the registration number shown explicitly or the certificates) will also be acceptable only in those cases where the student has valid reason for his/her absence from the University.

30. Conduct of Examination

1. Dean of the respective Faculty will announce the date of final examinations with recommendation from the respective heads of the departments at least one (01) week before the end of the semester classes.
2. Board viva will be held at 13^{th} week as convenient by the department.
3. There will be an Examination Committee for each examination in every department as:

Sl. No.	**Name**	**Remarks**
1.	Head	Chairman
2.	Three (03) Teachers within the University not below the rank of Assistant Professor	Members
3.	One (01) Teacher from within (not from the same department) or outside the University (Not below the rank of Associate Professor)	External Member

N.B: For 4th year backlog and short semester examination committee members including chairman will be six (o6).

4. Odd, Even, Backlog and Short Semesters will be treated as separate examinations.
5. Head of the department will put forward the proposal of formation of the examination committee to respective Dean of the Faculty. Dean will place this proposal to the Dean's executive committee for recommendation to the Academic Council's approval.
6. Chairman of the Examination committee will propose the name of the Paper Setters and Examiners from the panel of Paper setters and Examiners to the Vice-chancellor. Vice-Chancellor will appoint the examiners. Two Paper Setters and Examiners will be appointed for each course.
7. Examination Committee will moderate the questions for semester final, backlog and short semester examinations.
8. Chairman of the Examination committee will arrange to prepare question typing and printing (as required). The persons involved for preparation of question papers will be kept among the members of the respective examination committee.
9. Printed Questions will be sent to Dean in sealed envelope signed by the Chairman of the Examination committee and the person involved with question preparation at least 1(one) day before the examination.
10. Dean will keep the questions and will open and distribute the questions to the invigilators before the examination(s).
11. Results of Even semesters must be published before the start of next academic year.
12. Backlog examination must be completed within 2nd cycle of the odd semester.
13. After examinations all answer scripts will be submitted to Dean's office by the invigilators.
14. Examiners, who will perform invigilation duty, must collect the answer script from the Dean's office after the examinations on same day. All other examiners will collect the answer script from Dean's office on next office day.

31. Script Evaluation

There will be two sections in the questions and answer script. Each examiner will evaluate one section.

1. Examiners will send four copies of mark sheet along with marked answer script to the Chairman of Examination committee.
2. Chairman of the examination committee will send the answer script with mark sheet and questions to the scrutinizers for scrutiny.
3. Vice-Chancellor will appoint two Scrutinizers on recommendation from the Chairman of the examination committee.
4. Vice-Chancellor will appoint three tabulators/Data Entry Teachers on recommendation from the chairman of the examination committee. Advisor(s) or other teacher (as required) may be the Tabulators/ Data entry teachers for a particular series and will continue to do so until that series will pass away. However, the appointment will be on annual basis.
5. Chairman of the examination committee will provide the three copies of scrutinized mark sheets to the tabulators/Data Entry Teachers.
6. Chairman of the examination committee will arrange examination committee meeting for result finalization.
7. Tabulation will be done at a secured place under the supervision of the chairman of the examination committee.
8. Proper security measure is required to be taken.
9. Chairman of examination committee will send the three copies of prepared result along with one copy of scrutinized mark sheet to the Controller of Examination.
10. Controller of examination will publish the result after the approval of the Vice-Chancellor.
11. Grade sheets will be prepared and checked by the tabulators.

32. Special Instructions

1. Students will not be allowed to enter the examination hall after half an hour from the start of the final examination(s).
2. Students will not be allowed to leave the exam hall before completion of one hour from the start of examination.
3. Students are not allowed to keep any electronic device unless it is officially permitted.
4. Students normally will not be allowed to go outside the exam hall during examination.
5. Students will be under Ordinance related to discipline for any unfair means as laid out.

Chapter III
Ordinance Related to Discipline

General Discipline

1. There shall be a Board of Discipline to supervise and control the discipline of the students of the university
2. The Board shall consist of the following members

a. Under-Graduate (UG)

(i)	Vice-Chancellor	Chairman
(ii)	Pro Vice-Chancellor	Member
(iii)	All Deans	Member
(iv)	Heads of all Undergraduate Degree awarding Departments	Member
(v)	One Head from Faculty of Applied Science and Engineering to be nominated by the Vice-chancellor	Member
(vi)	Controller of Examination	Member
(vi)	Provosts of Halls of Residence	Member
(vii)	Director (Students Welfare)	Member Secretary

b. Post-Graduate (PG)

(i)	Vice-Chancellor	Chairman
(ii)	Pro Vice-Chancellor	Member
(iii)	All Deans	Member
(iv)	Heads of all Postgraduate Degree awarding Departments	Member
(v)	Director (Research & Extension)	Member
(vi)	Controller of Examination	Member
(vii)	Provosts of concerned Halls of Residence	Member
(viii)	Director (Students Welfare)	Member Secretary

3. One-third members shall form a quorum. The term of the nominated member shall be of two years.
4. All incidents which appear to the acts of indiscipline and misconduct committed by any student including immediate action taken, if any, shall be reported to the Vice-chancellor by/through the Director (Student Welfare) in respect of indiscipline and misconduct in the Halls of Residence and their premises and by the Head of Department in respect of indiscipline and misconduct in the class rooms, laboratories, workshops, all parts of the academic premises and any other place in the campus, and by the invigilator through the chief Invigilator (for UG)/ Invigilator (for PG) in respect of indiscipline and misconduct in examination halls, and by the person concerned from among the students and employees of the university in respect of the misconduct committed outside the university campus.
5. A student, who neglects his studies, disobeys and or denounces orders, rules and regulations, ordinances, statutes of the university, shows misbehavior towards the members of the staff or officers of the university or commits any other offence which will be deemed by the Vice-chancellor or Director (Students Welfare) or teachers of the university as misconduct and breach of discipline, will be liable to disciplinary action which may range from warning, imposition of fines, suspension to expulsion for good from the university depending on the magnitude of the offence as will be deemed fit by the authorities competent to take disciplinary action as defined in Section 6.
6. Authorities to take disciplinary action with their respective powers to the extent to which they can impose punishment on any student or group of students are:

Authorities for taking disciplinary actions	Power	Appellate Authority
(1)	(2)	(3)
Board of Discipline	Warning, imposing fine, suspension for any length of time, expulsion for good.	Academic Council
Vice-Chancellor	Warning, imposing fine, Suspension up-to six months	Board of Discipline
Director (Students Welfare)	Warning, imposing fine up-to 1000/-, suspension and expulsion from the Halls	Vice-Chancellor
Provosts (On resident or attached student of his hall of residence)	Warning, imposing fine up-to 500/-, suspension and expulsion from the Halls for a period of one academic year.	Director (Students Welfare)
Head of Department (On students of his Department)	Warning, imposing fine up-to 1000/- with a report to Director, Students Welfare for record.	Vice-Chancellor

7. If the Vice-Chancellor feels that the action taken against a student or a group of students (by any of the above authorities other than Board of Discipline) on an offence brought to him is not appropriate or that no action has been taken on any offence observed by him, he will take appropriate disciplinary actions against a student or a group of students. If however; in any case of breach of discipline the Vice-Chancellor is of the opinion that a punishment more than a suspension of six months is required he shall refer the matter to the Board of Discipline for a decision.
8. A student or a group of students against whom an action has been taken by appropriate authority mentioned in column (1) of Section 6 may prefer an appeal to the appropriate appellate authority mentioned in column (3) of Section 6.
9. Character certificates issued by the Director (Students Welfare) shall be produced by the students when the teachers and the Registrar of the University are requested for character certificate.
10. Character certificates issued by the Director (Students Welfare) shall be produced by the students when the teachers and the Registrar of the University are requested for character certificate.

Discipline at Examination

11. The chief Invigilator (for UG)/ Invigilator (for PG) shall be responsible for maintenance of discipline in the examination Halls.
12. An invigilator on duty in examination hall shall report to the chief Invigilator (for UG)/ Head of the department (for PG) in case of breach of discipline in the examination hall. The Chief Invigilator (for UG)/ Head of the department (for PG) may expel the examinee concerned from the hall debarring him from appearing in that particular examination.
13. Breach of discipline in the examination halls shall be reported by the invigilator through the Chief Invigilator (for UG)/ Head of the department (for PG) to the Vice-Chancellor.
14. The candidates shall strictly follow the following instructions:
    (i) Candidates are forbidden to write their names on the cover or any part of the answer script. If any candidate does so, his answer script will not be assessed.
    (ii) Each candidate must write legibly his Examination Roll Number on the cover of scripts. If any candidate omits to write his Examination Roll Number and Registration Number on the cover of his answer script, the paper may not be assessed.
    (iii) When more than one answer script is used each additional script should be stitched to the first script immediately after it is supplied, and the Examination Roll Number and Registration Number should also be written by the candidate on the cover of the additional script or scripts immediately.
    (iv) No additional paper will be provided for scribbling, and no paper is to be brought in for this purpose. Any candidate found with additional paper in his possession will be expelled from the examination hall. All works must be done in the scripts provided and pages must not be torn out. The scripts provided and pages must not be torn out. The scripts provided must be submitted. It cannot be replaced by another, but, if necessary, additional scripts will be given. All works intended for assessment by the examiner should be written on both sides of the paper.
    (v) Candidates are forbidden to write anything whatsoever on the question paper.
    (vi) In any matter not specially mentioned in these rules, candidates are required to abide by the decision of the invigilator in the examination hall.
    (vii) No candidate will be allowed to enter the examination hall after 30 minutes has elapsed from the time the question papers are given out.
    (viii) No candidate will be allowed to leave the examination hall until one hour has elapsed from the time the question papers are given out.
15. Disciplinary action will be taken against candidates reposted to have violated the instructions under Section 4 or resorted to unfair means and /or acts of indiscipline at the different examination as follows:
    (i) Attempts to communicate with other examinee or examinees in the examination hall: first time– warning which may be accompanied by a change of seats; second time– deduction of 5% of the total marks of paper; third time– expulsion from the examination hall for that paper.
    (ii) Possession of writings related to the particular subject of examination or copying from any other source: expulsion from examination hall and cancellation of that examination and expulsion from the university for one to two years. Writings in the person of the examinee or in his apparels, in papers, drawing instruments, scales and electronic gadgets

etc. found with him or off or near the desk, bench or chair will be considered as writings in possession of the examinee.

(iii) Use of violent language and holding out threats to examiners and invigilators: expulsion from the whole examination and/or expulsion from the University for Good.

(iv) Attempts to get possession of the question paper or examination scripts before the examination: expulsion from the whole examination and expulsion from the University for One to two years.

(v) Writings on additional papers not related to the examination (viz. blotting paper, question paper etc.): seizure of the writings and cancellation of the answer script and expulsion from the examination hall.

(vi) Attempts to influence the examiner; cancellation of the paper.

(vii) Impersonating or causing impersonate in the examination hall: cancellation of the whole examination and expulsion from the University for Good.

(viii) Insertion in the examination script, answer to any question or questions written outside the examination hall: cancellation of the whole examination and expulsion from the university for one to two years.

(ix) Having a question answered by someone else: cancellation of the whole examination and expulsion from the university for two years.

16. The invigilator is empowered to warn a student and deduct the mark up to 5% as mentioned in section 15(i) above. The Chief Invigilator (for UG)/head of the department (for PG) is empowered to expel students from the examination hall if he is satisfied on the spot enquiry that the student is guilty of misconduct mentioned in section 15 above. In all such cases the matter has to be reported to the Vice-Chancellor with incriminating documents, if any. Decisions for cancellation of the examination and expulsion from the university for a period of not exceeding six months. For expulsion for a period more than six months, the Vice-Chancellor shall refer the matter to the Board of Discipline provided in Section 6.

Chapter IV

Course Structure of Four-Year B.Sc. Engineering Program

Semester-wise Distribution of Credits

Sl.	Year/ Semester	Theory		Sessional		Total Credits
		No. of Course	Credits	No. of Course	Credits	
1	1st/Odd	5	15.00	5	5.25	20.25
2	1st/Even	5	15.00	4	3.75	18.75
3	2nd/Odd	5	15.00	5	4.50	19.50
4	2nd/Even	5	15.00	4	5.25	20.25
5	3rd/Odd	5	15.00	5	4.50	19.50
6	3rd/Even	5	15.00	5	4.50	19.50
7	4th/Odd	5	15.00	7	5.50	20.50
8	4th/Even	5	15.00	5	6.75	21.75
Total		**40**	**120.00**	**40**	**40.00**	**160.00**

Percentage (%) Distribution of Undergraduate Courses in ECE Department

Course Type	Percentage of Credit (%)	Credits
Basic Sciences and Mathematics	**12.18**	**19.50**
(a) Mathematics	7.50	12
(b) Physics	2.34	3.75
(c) Chemistry	2.34	3.75
Language and General Education	**7.98**	**12.75**
(a) History of Independence, Sociology and Environment Protection	1.88	3.00
(b) Legal Issues, Industrial & Operational Management	1.88	3.00
(c) Economics & Accountancy	1.88	3.00
(d) English	2.34	3.75
Other Engineering	**5.15**	**8.25**
(a) Mechatronics Engineering	2.34	3.75
(b) Mechanical Engineering	2.34	3.75
(c) Civil Engineering	0.46	0.75
Program Courses	**65.31**	**104.50**
(a) Core Electrical Engineering	29.53	47.25
(b) Core Computer Engineering	29.07	46.50
(c) Industrial training, Seminar, Project and Thesis	6.25	10.00
(d) Engineering Ethics	0.46	0.75
Technical Electives	**9.38**	**15.00**
(a) Electrical Engineering	4.69	7.50
(b) Computer Engineering	4.69	7.50
Total	**100.00**	**160.00**

Semester-wise Detail Course Distribution

Department will offer the courses to its students, in general, as per the following arrangement.

1st Year Odd Semester

Sl. No.	Course No.	Course Title	Theory		Sessional		Total Credits
			Contact Hrs/week	Credits	Contact Hrs/week	Credits	
1	ECE 1101	Circuits and Systems-I	3	3			3.00
2	ECE 1102	Circuits and Systems-I Sessional			3	1.50	1.50
3	ECE 1103	Computer Programming	3	3			3.00
4	ECE 1104	Computer Programming Sessional			3	1.50	1.50
5	Math 1117	Calculus and Ordinary Differential Equation	3	3			3.00
6	Phy 1117	Optics and Modern Physics	3	3			3.00
7	Phy 1118	Optics and Modern Physics Sessional			3/2	0.75	0.75
8	Hum 1117	Technical English	3	3			3.00
9	Hum 1118	Technical English Sessional			3/2	0.75	0.75
10	ECE 1100	Introduction to Computer System			3/2	0.75	0.75
		Total	**15**	**15**	**10.50**	**5.25**	**20.25**

1st Year Even Semester

Sl. No.	Course No.	Course Title	Theory		Sessional		Total Credits
			Contact Hrs/week	Credits	Contact Hrs/week	Credits	
1	ECE 1201	Circuits and Systems -II	3	3			3.00
2	ECE 1202	Circuits and Systems –II Sessional			3/2	0.75	0.75
3	ECE 1203	Object Oriented Programming	3	3			3.00
4	ECE 1204	Object Oriented Programming Sessional			3	1.5	1.50
5	ECE 1205	Analog Electronic Circuits-I	3	3			3.00
6	ECE 1206	Analog Electronic Circuits-I Sessional			3/2	0.75	0.75
7	Math 1217	Transform Methods, Statistics & Complex Variable	3	3			3.00
8	Hum 1217	Government, Sociology, Environment Protection & History of Independence	3	3			3.00
9	ECE 1200	Engineering Ethics			3/2	0.75	0.75
		Total	**15**	**15**	**7.50**	**3.75**	**18.75**

2nd Year Odd Semester

Sl. No.	Course No.	Course Title	Theory		Sessional		Total Credits
			Contact Hrs/week	Credits	Contact Hrs/week	Credits	
1	ECE 2103	Data Structure & Algorithms	3	3			3.00
2	ECE 2104	Data Structure & Algorithms Sessional			3	1.50	1.50
3	ECE 2105	Analog Electronic Circuits-II	3	3			3.00
4	ECE 2106	Analog Electronic Circuits-II Sessional			3/2	0.75	0.75
5	ECE 2111	Digital Techniques	3	3			3.00
6	ECE 2112	Digital Techniques Sessional			3/2	0.75	0.75
7	Math 2117	Vector Analysis & Linear Algebra	3	3			3.00
8	Chem 2117	Inorganic and Physical Chemistry	3	3			3.00
9	Chem 2118	Inorganic and Physical Chemistry Sessional			3/2	0.75	0.75
10	ECE 2100	Software Development Project- I			3/2	0.75	0.75
		Total	**15**	**15**	**9.00**	**4.50**	**19.50**

2nd Year Even Semester

Sl. No.	Course No.	Course Title	Theory		Sessional		Total Credits
			Contact Hrs/week	Credits	Contact Hrs/week	Credits	
1	ECE 2207	Electrical Machine-I	3	3			3.00
2	ECE 2208	Electrical Machine-I Sessional			3/2	0.75	0.75
3	ECE 2213	Numerical Methods & Discrete Mathematics	3	3			3.00
4	ECE 2214	Numerical Methods & Discrete Mathematics Sessional			3	1.50	1.50
5	ECE 2215	Data Base Systems	3	3			3.00
6	ECE 2216	Data Base Systems Sessional			3	1.50	1.50
7	Math 2217	Co-ordinate Geometry & Partial Differential Equations	3	3			3.00
8	Hum 2217	Legal Issues, Industrial & Operational Management	3	3			3.00
9	ECE 2200	Electronic Shop Practice			3	1.50	1.50
		Total	**15**	**15**	**10.50**	**5.25**	**20.25**

3rd Year Odd Semester

Sl. No.	Course No.	Course Title	Theory		Sessional		Total Credits
			Contact Hrs/week	Credits	Contact Hrs/week	Credits	
1	ECE 3107	Electrical Machine-II	3	3			3.00
2	ECE 3108	Electrical Machine-II Sessional			3/2	0.75	0.75
3	ECE 3111	Microprocessor, Assembly Language & Interfacing	3	3			3.00
4	ECE 3112	Microprocessor, Assembly Language & Interfacing Sessional			3	1.5	1.50
5	ECE 3117	Software Engineering & Information System Design	3	3			3.00
6	ECE 3118	Software Engineering & Information System Design Sessional			3/2	0.75	0.75
7	ECE 3119	Computer Architecture and Design	3	3			3.00
8	ECE 3121	Electromagnetic Fields & Waves	3	3			3.00
9	CE 3100	Civil Engineering Drawing			3/2	0.75	0.75
10	ECE 3100	Software Development Project -II			3/2	0.75	0.75
		Total	**15**	**15**	**9.00**	**4.50**	**19.50**

3rd Year Even Semester

Sl. No.	Course No.	Course Title	Theory		Sessional		Total Credits
			Contact Hrs/week	Credits	Contact Hrs/week	Credits	
1	ECE 3205	Industrial Electronics	3	3			3.00
2	ECE 3206	Industrial Electronics Sessional			3/2	0.75	0.75
3	ECE 3207	Communication Engineering	3	3			3.00
4	ECE 3208	Communication Engineering Sessional			3/2	0.75	0.75
5	ECE 3221	Operating System	3	3			3.00
6	ECE 3222	Operating System Sessional			3/2	0.75	0.75
7	ME 3219	Basic Mechanical Engineering	3	3			3.00
8	ME 3220	Basic Mechanical Engineering Sessional			3/2	0.75	0.75
9	Hum 3217	Economics & Accountancy	3	3			3.00
10	ECE 3200	Electrical Services Design			3	1.50	1.50
		Total	**15**	**15**	**9.00**	**4.50**	**19.50**

4th Year Odd Semester

Sl. No.	Course No.	Course Title	Theory		Sessional		Total Credits
			Contact Hrs/week	Credits	Contact Hrs/week	Credits	
1	ECE 4109	Power System	3	3			3.00
2	MTE 4117	Control Systems & Robotics	3	3			3.00
3	MTE 4118	Control Systems & Robotics Sessional			3/2	0.75	0.75
4	ECE 4123	Digital Signal Processing	3	3			3.00
5	ECE 4124	Digital Signal Processing Sessional			3/2	0.75	0.75
6	ECE 41**	Optional I	3	3			3.00
7	ECE 41**	Optional I Sessional			3/2	0.75	0.75
8	ECE 41**	Optional II	3	3			3.00
9	ECE 41**	Optional II Sessional			3/2	0.75	0.75
10	ECE 4000	Thesis/ Project-I			2	1.00	1.00
11	ECE 4100	Industrial Training			3/2	0.75	0.75
12	ECE 4122	Seminar			3/2	0.75	0.75
		Total	**15**	**15**	**11.00**	**5.50**	**20.50**

****Industrial Training:** Students will be attached with the industries/service agencies for two weeks after completing their Third year first semester (before starting Third year second semester/during any vacation in Third year second semester) to gain practical knowledge.

**** Optional Courses for 4th year Odd Semester:**

Two optional courses with Sessional (Optional I & Optional II) will be offered to the students according to the following list:

Sl.	Optional I		Sl.	Optional II	
	Course No.	Course Title		Course No.	Course Title
1	ECE 4111	Digital Communication	1	ECE 4127	VLSI Design
2	ECE 4115	Antennas & Propagations	2	ECE 4129	Network Planning
3	ECE 4117	Radar & Satellite Communication	3	ECE 4131	Wireless Networks
4	ECE 4125	Radio & TV Engineering	4	ECE 4133	Artificial Intelligence
5	ECE 4141	Fiber optic Communication	5	ECE 4135	Human Computer Interaction
6	ECE 4143	Bio-medical Engineering			

4th Year Even Semester

Sl. No.	Course No.	Course Title	Theory		Sessional		Total Credits
			Contact Hrs/week	Credits	Contact Hrs/week	Credits	
1	ECE 4209	Power Station, Switchgear & Protection	3	3			3.00
2	ECE 4211	Computer Networks	3	3			3.00
3	ECE 4212	Computer Networks Sessional			3/2	0.75	0.75
4	ECE 4223	Digital Image Processing	3	3			3.00
5	ECE 4224	Digital Image Processing Sessional			3	1.50	1.50
6	ECE 42**	Optional III	3	3			3.00
7	ECE 42**	Optional III Sessional			3/2	0.75	0.75
8	ECE 42**	Optional IV	3	3			3.00
9	ECE 42**	Optional IV Sessional			3/2	0.75	0.75
10	ECE 4000	Thesis/ Project -II			6.0	3.00	3.00
		Total	**15**	**15**	**13.50**	**6.75**	**21.75**

Optional Courses for 4th year Even Semester:

Two optional courses with sessional (Optional III & Optional IV) will be offered to the students according to the following list:

Sl.	Optional III		Sl.	Optional IV	
	Course No.	**Course Title**		**Course No.**	**Course Title**
1	ECE 4221	Unix Programming	1	ECE 4247	Computer Aided Instrumentation
2	ECE 4227	Network Security	2	ECE 4249	Computer Aided Power System Design
3	ECE 4237	Parallel & Distributed Processing	3	ECE 4251	Renewable Energy
4	ECE 4239	Computer Graphics & Animations	4	ECE 4253	Microwave Engineering
5	ECE 4241	Computer Vision	5	ECE 4255	Power System Operation & Control
6	ECE 4243	Data Mining	6	ECE 4257	High Voltage Engineering
7	ECE 4245	Machine Learning	7	ECE 4259	System Simulation & Modeling

Course Contents

1st Year Odd Semester

ECE 1101: Circuits & Systems-I **Credits: 3.00**

DC Analysis: Introduction of electrical power sources, ideal and practical sources, linear circuit elements, DC analysis of series, parallel and series-parallel circuits. Kirchhoff's Voltage and current laws, voltage, current, power and energy.
Sinusoidal Wave: Average and effective values, form factor, peak factor, phase relation and phasors. Steady state AC analysis of series, parallel and series parallel circuits, phase relation between voltage and current, concept of impedance, power, power factor, phasor diagram.
Network Theorems: Superposition theorem, Thevenin's theorem, Norton's theorem, maximum power transfer theorem, substitution theorem and reciprocity theorem. Frequency response of ac circuits, resonance phenomena, periodic signals in time and frequency domains. Circuit analysis using proper simulation tools.
Magnetic Circuit and Concepts: Flux, fields, permeability reluctance, analysis of series, parallel and series- parallel magnetic circuit.

ECE 1102: Circuits & Systems-I Sessional **Credits: 1.50**

Sessional based on the theory of course ECE 1101

ECE 1103: Computer Programming **Credits: 3.00**

Introduction to Computer Programming: Compiler, Interpreter, Flow chart design, Writing, Debugging and running programs using C/C++.
C Basics: Different data types and variables, Operator and operands and its precedence, Input/Output, Conditional operators, Loop structures, Error handling, and Built-in functions.
Functions and Arrays: Writing & calling of user defined functions, Recursive functions, Introduction to one-dimensional arrays, Multi-dimensional arrays and array manipulation.
Pointers and Strings: Introduction to pointers, Pointers and array, Pointers and functions, Scope of variables, Dynamic memory allocation, String I/O, String-based built-in functions, String operations, Pointer and string.
Files: Introduction to files in C, Opening, Closing and updating binary and sequential files.
Advanced Topics: Structure, Union, Enumeration, Bit fields, Operations on bits, Register variable, Pre-processors and graphics in C.

ECE 1104: Computer Programming Sessional **Credits: 1.50**

Sessional based on the theory of course ECE 1103.

Math 1117: Calculus & Ordinary Differential Equation **Credits: 3.00**

Differential Calculus: Rolle's theorem, Mean value theorem. Taylor's and Maclaurin's theorems in finite and infinite forms. Divergency and Convergency of series. Partial differentiation, Euler's theorem. Tangent, normal and curvature. Determination of maximum and minimum values of functions and their application.
Integral Calculus: Use of definite integration in summing series. Walli's formulae. Improper integrals. Beta and Gamma functions. Area under a plane curve and area of a region enclosed by two curves in Cartesian and polar coordinates. Volume and surface areas of solids of revolution.
Ordinary Differential Equation: Degree and order of ordinary differential equations. Formation of differential equations. Solutions of first order differential equations by various methods, Solutions of general linear differential equations of second and higher orders with constant coefficients, Solution of homogeneous linear differential equation. Solution of differential equation with constant coefficients by operator method.

Phy 1117: Optics and Modern Physics **Credits: 3.00**

Optics: Theories of light: Huygens's principle and construction. Interference of light. Young's double slit experiment, Fresnel bi-prism, Newton's ring, Interferometers. Diffraction of light: Fresnel and fraunhofer diffraction, Diffraction by single and double slit, diffraction gratings. Polarization: Production and analysis of polarized light, Optical activity, Optics of crystals.
Waves and Oscillations: Oscillations: Simple Harmonic Motion, Transverse and Longitudinal nature of waves: Travelling and Standing waves. Intensity of a wave, energy calculation of progressive and Stationary waves. Phase velocity, Group velocity. Sound waves: Velocity of longitude wave in a gaseous medium, Doppler effect.
Architectural acoustics: Sabine's formula, requisites of a good auditorium.
Modern Physics: Atom models: Thomson model, Rutherford atom model, Electron orbits, Bohr atom model, Energy levels and spectra, Particle properties of waves: Photo electric effect, Einstein's photoelectric equation, Laws of photoelectric emission, Compton Effect, Quantum effect: de Broglie waves, Group velocity, phase velocity. Michelson Morley's experiment, Galilean transformation. Spectral theory of relativity, Lorentz Transformation. Relative velocity, length contraction, time dilation, relativity of mass. Mass-energy relation.

Phy 1118: Optics and Modern Physics Sessional **Credits: 0.75**

Sessional based on the theory of course Phy 1117.

Hum 1117: Technical English **Credits: 3.00**

Grammar: Grammatical principles, modals, phrases & idioms, prefixes & suffixes, sentence structures, w-h & yes/ no question, conditional sentences
Vocabulary: Technical & scientific vocabulary, defining terms
Spoken English: Introduction to phonetic symbols, dialogue, responding to particular situations, extempore speech.
Reading: Comprehension of technical & non-technical materials skimming, scanning, inferring & responding to context
Technical writing: Paragraph/essay writing on scientific & other themes, report writing, research paper writing, library references,
Professional communication: Business letter, job application, memos, quotations, tender notice

Hum 1118: Technical English Sessional **Credits: 0.75**

Sessional based on the theory of course Hum 1117.

ECE 1100: Introduction to Computer System **Credits: 0.75**

Computer Fundamentals: Introduction to computer basics, types and generation of computers, basic organization and functional units.
Hardware: Basic units of computer hardware, Processors, input, output and memory devices, keyboard, mouse, OMR, OCR, MICR, CD-ROM, printers, CRT, LCD, LED, microfilm, floppy.
Software: Types of software, system software: familiarization with various operating systems (Windows, DOS, UNIX, Android, IOS etc.), application software: text processing (MS-WORD, etc.), Spread sheet (MS-EXCEL etc.).
Computer Ethics: Computers in the workplace, computer crime, rules of communications, privacy, intellectual property, impact on employment, professional responsibility, and globalization.

1st Year Even Semester

ECE 1201: Circuits & Systems-II **Credits: 3.00**

Polyphase System: Balanced and unbalanced three phase circuit analysis. Two-port network analysis. Coupled circuit. Analogous system, Response to non-sinusoidal voltage.
Linear System: Transform methods, Purpose and nature of transform, Fourier and Laplace transforms. Impulse function. Convolution integral and their application to network and system analysis.
Filter: Introduction to filter, Filter equations, Modern filters.

ECE 1202: Circuits & Systems-II Sessional **Credits: 0.75**

Sessional based on the theory of course ECE 1201.

ECE 1203: Object Oriented Programming **Credits: 3.00**

Fundamentals of OOP: Introduction to Object Oriented Programming, Principles of Object-Oriented Design.
Classes and Objects: Structure of Class, Access Modifiers, Encapsulation and Information-hiding, Inheritance, Polymorphism, Data binding, Static and dynamic binding, Nested Classes, Abstract Classes, Interface, Arrays of Objects, Pointer to Objects, Friend function, Data abstraction.
Constructors and Destructors: Default constructor, Copy constructor, Dynamic constructor, Constructor function for derived classes and their order of execution, Destructor.
Inheritance: Mode of inheritance, Single inheritance vs. multiple inheritance, Virtual inheritance.
Polymorphism: Operator and Function overloading, Run-time and Compile time Polymorphism, Virtual function, Errors and Exception Handling.
Advanced Topics: Persistent Objects, Objects and Portable Data, UML Basics, GUI Design (Frame, Panel, Button, Different I/O fields etc.), Multithreading.

ECE 1204: Object Oriented Programming Sessional **Credits: 1.50**

Sessional based on the theory of course ECE 1203.

ECE 1205: Analog Electronic Circuits-I **Credits: 3.00**

Signal: Signals, their origin and processing in electronic system. Development of electronic processing devices, Vacuum tubes and semiconductor devices, P-N junction semiconductor diodes, Application of diode as rectifier, Zener diode and its application.

BJT, FET, MOSFET: Characteristics, Biasing techniques, Stabilization factors, Compensation. Equivalent circuits, single stage amplifiers at midband frequencies. Power amplifiers and Heat sink.

ECE 1206: Analog Electronic Circuits-I Sessional **Credits: 0.75**

Sessional based on the theory of course ECE 1205.

Math 1217: Transform Methods, Statistics & Complex Variable **Credits: 3.00**

Harmonic Analysis and Laplace Transform: Periodicity**,** Fourier series, Dirichlet's conditions, odd and even functions, Fourier transforms and Fourier integral and their applications to solve boundary value problems. Laplace transforms, Inverse Laplace transforms, Solution of differential equation by Laplace transforms.

Statistics: Frequency distribution, mean, median, mode, and other measures of central tendency, standard deviation and other measures of dispersion, moments, skewness and kurtosis, elementary probability theory and discontinuous probability distributions- binomial, Poisson, negative binomial, continuous probability distributions- exponential and normal distribution, characteristics, elementary sampling theory, estimation, hypothesis testing and regression analysis.

Complex Variable: Complex number systems, analyticity, singularity, limits of continuity of a function and related theorems, Complex differentiation and the Cauchy-Riemann equations, mapping by elementary functions, Infinite series, Convergence, Line integration, Cauchy integral theorem, Cauchy integral formula, Liouville's theorem, Taylor's and Laurent's theorems, Singular points, Residue, Cauchy's residue theorem, Contour integration.

Hum 1217: Government, Sociology, Environment Protection & History of Independence **Credits: 3.00**

History of Independence: The movements during British period (1857-1947), Language Movement of 1952. Background of Independence: Six Points and Bengali Nationalism in 1966, Mass Upsurge in 1969, The General Election of 1970 and Later Events, Historic Speech of 7th March by Bangabandhu, The Genocide of 25th March. The Birth of Independent Bangladesh in 1971.

Sociology & Government: Scope, Culture and civilization Relationship, Social structure of Bangladesh. Industrial revolution, Urbanization and industrialization,

Urban Ecology, Cyber-crime and delinquency, Sociology of Education. Relationship-Sociology and cyber-crime. Causes and remedies of cyber-crime.

Basic concepts of government and politics. Functions, Organs and forms of modern state and Government, Socialism. Capitalism, UNO, government and politics of Bangladesh, Some major administrative systems of developed counties. Local self-government. Central government, Public opinion.

Environmental Protection: The environment and environmental protection, Sustainability and the difficulty of environmental protection, unintended consequences of actions and effects on the environment, Developing countries and environmental problems.

Pollution: Types of Environmental pollutions and threats, Source of pollution and their types, controlling pollution and improving quality. Climate change and global warming: Causes, effects and future.

Environmental Laws: National and global environmental law and policy, economic steps to protect the environment.

ECE 1200: Engineering Ethics **Credits: 0.75**

Introduction to Engineering Ethics: Overview of Ethics, Engineering Ethics, Codes of Ethics, Principles of engineering ethics, Individual, Professional, and Institutional Values, Leadership in Engineering and Industry, Competency with Good Character.

Ethical Theories, Rights & Protection: Liberal Individualism, Utilitarianism/Consequentialism and Deontology, Protections of Human –Animal Subjects and environment, Data Management and Intellectual Property Rights.

Research Integrity and Professional Integrity for Engineers: Research Integrity: Scientific misconduct- falsification of data, fabrication of data, plagiarism, unethical treatment of research subjects, and failure to disclose conflicts of interest. Engineering ethics, Professional Integrity/Ethics- fraud, corruption, mismanagement, poor product, design, deliberate design faults or and harms from engineering projects/products

Sustainability and Engineering Ethics: overview of sustainability, current topics in engineering ethics regarding sustainability: adaptive design, green technologies, and other appropriate topics in sustainability.

Case Studies: B.F. Goodrich Air Force A7-D Brake Problem Case and the Whistleblowing Debate, Finish Challenger Case, Ford Pinto Case, Chernobyl and Three Mile Island, and current cases.

2nd Year Odd Semester

ECE 2103: Data Structure & Algorithms **Credits: 3.00**

Data Structure Introduction: Concepts and Examples of Elementary Data Objects, Necessity of Structured Data, Types of Data Structure, Ideas on Linear and Nonlinear Data Structure.

Linear Array: Linear Array & its representation in memory, Traversing LA, Insertion & Deletion in LA, Bubble Sort, Linear Search & binary Search, Multidimensional Array & its representation in memory, Algebra of matrices, Sparse matrices.

Stack and Queue: Stack representation & applications, PUSH and POP operation on stack, Queue representation, Insertion & deletion in Queue, Priority Queues.

Linked List: Linked list & its representation in memory, Traversing, Searching, Insertion & Deletion operation on Linked list, Circular List, Header linked lists, Two-way lists.

Tree: Tree terminology, representation of binary trees in memory, Traversing binary tree, Binary search tree, Insertion & deletion on binary search tree, B trees, General tree.

Algorithm Complexity: Algorithm and flow chart, Complexity analysis of algorithms, worst case, best case and average case, Rate of growth, Big-O notation, Complexity of Linear Search & Binary search.

Sorting Algorithms: Insertion sort, selection sort, quick sort, merge sort, Searching & data modification, Hash function, collision resolution, Chaining.

Shortest Path: Dijkstra's Algorithm, Bellman-Ford Algorithm.

Searching algorithms: Binary search trees, balanced binary search trees, B-trees, skip lists, hashing. Priority queues, heaps.

Graph algorithms: Representation of Graphs, Breadth First Search, Depth First Search, Minimum Spanning Tree.

Recurrences & Backtracking: Recurrences, NP-Hard and NP-Complete Problems, Backtracking, n-Queen Problem.

ECE 2104: Data Structure & Algorithms Sessional **Credits: 1.50**

Sessional based on the theory of course ECE 2103.

ECE 2105: Analog Electronic Circuits-II **Credits: 3.00**

BJT, FET, MOSFET: Multistage amplifier circuits. Frequency response of single stage and multistage amplifiers. Introduction to CMOS and its applications.

Feedback Concept: Improvement of amplifier characteristics by negative feedback. Classification, analysis of feedback amplifiers. Op-amps and its applications, integrator and differentiator, Frequency response, bandwidth and other practical limitations of op-amps, compensation techniques. Oscillators and multi-vibrators. Active filters. Negative impedance converters. Times 555 and its applications.

ECE 2106: Analog Electronic Circuits-II Sessional **Credits: 0.75**

Sessional based on the theory of course ECE 2105.

ECE 2111: Digital Techniques **Credits: 3.00**

Information and Digital Systems: Introduction to digital systems, Number Systems, weighted and non-weighted codes, error detection code, Binary addition and subtraction, 2's compliment methods.

Boolean Algebra and Combinational Logic Circuits: Digital logic, Boolean algebra, Boolean function, Canonical forms, Karnaugh Maps, Minimization of Boolean functions, Logic gates and their truth tables, Design methodologies, Combinational logic circuit design, Arithmetic and data handling logic circuits. Decoders, Encoders, Multiplexer, Demultiplexer.

Flip Flop and Sequential Logic Circuits: Transistor Latch, NAND gate latch, NOR gate latch, D latch. Clock signals and Clocked FFs: Clocked SR, JK and D Flip-Flops, Master/Slave JK FF, timing diagram of different FFs, Edge-triggered and level-triggered timing diagrams, Counters, registers, memory devices and their applications, state machine.

Technology Parameters: Fan in, Fan out, Propagation delay, Power dissipation and noise immunity.

ECE 2112: Digital Techniques Sessional **Credits: 0.75**

Sessional based on the theory of course ECE 2111.

Math 2117: Vector Analysis & Linear Algebra **Credits: 3.00**

Vector Analysis: Vectors, Differentiation and integration, Line, surface and volume integrals, Gradient of a function, Divergence and curl of vector and their applications, Physical significance of gradient, divergence and curl, Vector identities, Integral forms of gradient, divergence and curl, Green's, Gauss's divergence and Stock's theorem.

Matrix: Definition of matrices, Equality of two matrices, Addition, Subtraction and Multiplication of matrices, Equivalence of matrices, Positive and Negative matrices, Adjoint of matrices, Transpose and inverse of matrices, Rank and normal form of matrices, System of linear equations, Solution of homogeneous and non-homogeneous systems, Determination of Eigen values and Eigen vectors, Solution of matrix differential equations.

Linear Algebra: Vector space, Subspace, sum and direct sum, Hilbert space, Normed linear space, Branch space, Basis and Dimension, Linear transformation: Range, Kernel, Nullity, singular and non-singular transformation, Linear operations: Matrix representation of a linear operator, Change of basis, Similarity and linear mapping.

Chem 2117: Inorganic and Physical Chemistry **Credits: 3.00**

Atomic structure- general concept of fundamental particles, Boh'r model, spectrum, quantum number, and electronic configuration.

Periodic Table and Periodic Properties- periodic law, features of modern periodic table, classification of elements, merits and demerits, periodicity, atomic size, ionization potential, electron affinity, and electronegativity.

Chemical Bonding- different types of chemical bonds and their properties.

Acid and bases- modern concepts of acid and bases, pH and buffer solution. Titration.

Solution- Types and composition of solution, Henry's law, and solution of gas in liquid, solid in liquid, colligative properties of dilute solution, lowering of vapor pressure, elevation of boiling point, depression of freezing point, osmosis and osmotic pressure.

Chemical Kinetics- Rate of reaction, order, molecularity, different types of rate expressions, effect of temperature on reaction rate, collision theory.

Chemical Equilibrium- Reversible reaction, law of mass action, evaluation and characteristics of equilibrium constant of reaction, the Lechatelier's principle.

Thermochemistry- Laws of thermochemistry, heat of reaction, heat of solution, heat of neutralization, heat of formation, heat of combustion, and experimental determination of thermal changes during chemical reactions.

Electrochemistry-electrolytes, mechanism of electrolyte conduction and different types of cells.

Chem 2118: Inorganic and Physical Chemistry Sessional **Credits: 0.75**

Sessional based on the theory of course Chem 2117.

ECE 2100: Software Development Project-I **Credits: 0.75**

Students will develop one or more programs/projects on same practical problems with sound software engineering practices as assigned by teacher.

2nd Year Even Semester

ECE 2207: Electrical Machine-I **Credits: 3.00**

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 connections, Vector group of three phase transformers, Phase conversion.

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, Induction generator.

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

ECE 2208: Electrical Machine-I Sessional **Credits: 0.75**

Sessional based on the theory of course ECE 2207.

ECE 2213: Numerical Methods & Discrete Mathematics **Credits: 3.00**

Modeling, Computers and Error Analysis: Mathematical modeling and engineering problem solving, Programming and software, Approximations and round-off errors, Truncation errors and the Taylor series.

Roots of Equations: Bracketing Methods, Open Methods, Roots of polynomials. Linear Algebraic Equations: Gauss elimination, LU Decomposition and Matrix Inversion, Gauss-Seidel.

Curve Fitting: Least-square Regression. Interpolation, Interpolation with one and two independent variables, Formation of different difference table, Newton's forward and backward difference, LaGrange's interpolation.

Numerical Integration: Newton-Cotes Integration formulas, Integration of equations.

Optimization: One-dimensional Unconstrained optimization.

Numerical Differentiation and Differential Equations: Runge-Kutta Methods, Boundary-Value and Eigenvalue problems, Numerical solution of partial differential equations

Set: Operations on Sets, Algebraic Properties of Set, Computer Representation of Set, the Power Set Theorem.
Relation: Property of Relation, Binary Relations, Partial Ordering Relations, Equivalence Relations.
Propositional Logic: Syntax, Semantics, Valid, Satisfiable and Unsatisfiable Formulas, Encoding and Examining the Validity of Some Logical Arguments, Predicate and Quantifier, Universal and Existential Quantification, Modus Ponens and Modus Tollens.
Proof Techniques: The Structure of Formal Proofs, Direct Proofs, Proof by Contradiction, Mathematical Induction
Number Theory: Theorem of Arithmetic, Modular Arithmetic, GCD, LCM, Prime Number, Congruence, Application of Congruence, Application of Number Theory, Chinese Remainder Theory.
Introduction to Counting: Basic Counting Techniques - Inclusion and Exclusion, PigeonHole Principle, Permutation, Combination.

ECE 2214: Numerical Methods & Discrete Mathematics Sessional **Credits: 1.50**

Sessional based on the theory of course ECE 2213.

ECE 2215: Data Base Systems **Credits: 3.00**

Concepts of database systems: Files and Databases, Database Management Systems, Transaction management, Structure of a DBMS, Applications
Entity-Relationship concepts: Entity types, Entity set, Attribute and key, Relationships, Relation types, Entity relationship, ER modeling, ER diagrams, Database design using ER diagrams, Enhanced Entity-Relationship (EER) model
Normalization: Normal forms, Normalized Relations and Database performance, De-normalization
Relational model: Structure of relational databases, Relational algebra, Relational algebra operations, Modification of the database, Introduction to views, Pitfalls in relational database design.
SQL: Data Definition Language, Data Manipulation Language, Basics of SQL, Query designing in SQL using aggregate functions and nested queries, Embedded SQL, Triggers, Procedures, Indexes, Declarative Constrains and Database Triggers
Concurrency control: Lock based protocols, Timestamp based protocols, Validation based protocols, Deadlock.

Recovery system: Failure classification, Storage structure, Recovery and atomicity, Log-based recovery, Recovery with concurrent transactions, Advanced recovery techniques, RAID model.
Advanced database management systems: No SQL Systems, distributed systems, object-oriented System, Temporal, Database Security, Data Warehousing and Data Mining, Database Administration and Tuning.

ECE 2216: Data Base Systems Sessional **Credits: 1.50**

Sessional based on the theory of course ECE 2215.

Math 2217: Co-ordinate Geometry and Partial Differential Equations **Credits: 3.00**

Co-ordinate Geometry: Coordinate geometry of three dimension- System of coordinates, transformations of coordinates, distance between two points, section formula, projection, direction cosines, equations of planes and lines.
Partial differential equations: Four rules for solving simultaneous equations of the form P=Q=r, Lagrange's method of solving PDE of order one, Integral surfaces passing through a given curve, Non-linear PDE of order one (complete, Particular, Singular and general integrals), Charpit's method, Second order PDE, Its nomenclature and classifications to canonical (Standard) parabolic, elliptic, hyperbolic, Solution by separations of variables, Linear PDE with constants coefficients.
Series solution: Solution of differential equations in series by the method of Frobenius, Bessel's functions, Legendre's Polynomials and their properties.

Hum 2217: Legal Issues, Industrial & Operational Management **Credits: 3.00**

Business and industrial law: Law of contract, elements of valid contract. Consideration, Parties competent to contact. Sale of goods, hire and purchase. Negotiable instrument.
Industrial law in Bangladesh: various ordinance payments of wages, legislation relating employment in industries, factories, shops and agriculture, trade union act.
Industrial Management: Principles of Management, Management functions, Management Skills, Authority and Responsibility, Span of Control, Management by Objective, Consultative Management, Participative Management, Decision Making, Manpower Motivation, Human **Resources Management:** Manpower planning, recruitment and selection, Employee Training and Development, Performance Appraisal, Wages and Salary administration, Production Management: Plant Layout: definition, basic layout types, problem solving, Linear

Programming, EOQ, Lead Time, Safety Stock, Re-order Point.

Operational Management: Production systems, product/service life cycle, forecasting models, bill of materials, material and inventory management: Inventory models, ABC analysis, coding and standardization. Aggregate planning, MPS, MRP, capacity planning, operating scheduling, facility location algorithm, facility layout techniques, work study.

Safety: Evolution of modern safety concepts, industrial hazard, safety and risk management, productivity, worker health and safety, proactive management techniques for safety management, safety standards and regulations for engineering works, fire safety, hazardous materials.

ECE 2200: Electronic Shop Practice **Credits: 1.50**

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

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

3rd Year Odd Semester

ECE 3107: Electrical Machine-II **Credits: 3.00**

DC Generators: Types, no-load voltage characteristics, buildup of a self-excited shunt generator, load-voltage characteristic, effect of speed on no-load and load characteristics and voltage regulation, armature reaction.

DC Motor: Operating principle, counter emf, torque, speed, torque-speed characteristics, starting, braking, and speed control.

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, loading effect, effect of changing excitation, V-curves, and starting methods.

Special machines: Stepper motor, Hysteresis motor, Servo motor, Repulsion Motor, Magnetic levitation etc.

ECE 3108: Electrical Machine-II Sessional **Credits: 0.75**

Sessional based on the theory of course ECE 3107.

ECE 3111: Microprocessor, Assembly Language & Interfacing **Credits: 3.00**

Microprocessor and Microcomputer Based System Design: Introduction to different types of microprocessors and its applications, organization of Intel 8086/8088 Microprocessor, the component of microcomputer system, Hardware and software interfacing in microcomputer system design, hardware and I/O design, building, debugging, testing and linking program modules, programming EPROM.

I/O Controller and Interrupt Components: 8284A programmable timer, bus architecture, bus timing, 8286 transceiver device, 8282 latches, 8288 bus controller, Sources of interrupt, types of interrupts, handling interrupt request, interrupt vector and table, 8259A priority interrupt controller, daisy chain, DMA controller i.e., 8237A DMA Controller, interrupt controller, communication interface, interval timer, etc.

Interfacing and Peripheral System: Interfacing ICs of I/O Devices, I/O ports, Programmable peripheral interface, I/O interface, serial I/O interface, 8251A communication interface, 8255A Programmable peripheral Interface.

Introduction of Assembly Language: Program structure and its components, few basic instruction, input/output instruction.

Flag Register and Flow Control: The flag register, flow control instructions, conditional and unconditional jumps, branching and looping structures.

Logic and Arithmetic Operation: Logic, Shift and Rotate Instruction, multiplication and division Instructions.

Arrays, Data Structure and String Manipulation: Arrays and related addressing modes, DUP operator, register indirect modes, Based and Indexed addressing modes, basic stack operations, procedures declaration, communication between procedures, calling a procedure, the string instructions, director flag, moving a string, storing a string, loading a string, scanning a string, comparing strings, substring operation

ECE 3112: Microprocessor, Assembly Language & Interfacing Sessional **Credits: 1.50**

Sessional based on the theory of course ECE 3111.

ECE 3117: Software Engineering & Information System Design **Credits: 3.00**

Introduction: Introduction to Software and its Nature, Software Engineering Methods, Different Types of Software Process Model.

Software Requirement Analysis and design: Software Requirements Analysis and their Applications, Software Prototyping.
Design of Software: Software Design and its Different Techniques, Software Configuration Managements. System Structuring, Control Models
Software Testing: Verification and Validation Planning, Software's Testing Strategies and Different Type of Testing Techniques,
Software Quality Assurance: Management and its Quality Assurance, Concepts of Software Reengineering.
Application Development Policy and Strategies: Planning of Information System, Policy in Information System Development, Strategies for Achieving Information System Goals.
Application System Development Life Cycle: Phases in Application System Development, Interrelationship among Each Phase. Feasibility Assessment: Problems and Needs in Information System Development.
Feasibility Assessment: Economic, Technical, Operational and Schedule Feasibility.
Information Requirements Determination: Strategies for Obtaining Information Requirements, Methods for Providing Assurance that Requirement are Correct and Complete.
Structured Systems Analysis & Design: Steps in Structured Systems Analysis, Activity Diagrams and Related Documentation, Problem Analysis, New System Design.

ECE 3118: Software Engineering & Information System Design Sessional **Credits: 0.75**

Sessional based on the theory of course ECE 3117.

ECE 3119: Computer Architecture and Design **Credits: 3.00**

Introduction to computer Architecture: Internal structure of processor/CPU– registers, PC, ALU, CU, etc. Bus architecture and processor interaction with memory and peripherals, Memory hierarchy in terms of cache memory, main memory, secondary storage, Memory organization into bytes and words, big-endian and little-endian organization, Computer Peripherals, Introduction to Von Neumann SISD organization, RISC and CISC machines.
Computer Arithmetic: Representation of strings, Binary and hex integer representations and conversions, Signed and unsigned formats, 2's complement, Computer integer arithmetic, Fixed-point arithmetic, IEEE floating point representation and arithmetic.

Process and Control: Fetch-Execute cycle, Encoding and decoding of MIPS machine instructions, The MIPS CPU instruction set syntax and semantics, addressing modes, MIPS assembly language programming, register usage conventions, use of stack and stack-frame for supporting function calling with parameters, Operating system calls and I/O operations. CPU and It`s Instruction Set Design.
Application HDL and FPGA for microcomputer design: Introduction to FPGA and HDL/VHDL for digital design implementation.

ECE 3121: Electromagnetic Fields & Waves **Credits: 3.00**

Electrostatics and Magneto statics using vector methods. Fields in dielectrics and conductors. Boundary conditions of Electric and Magnetic fields. Time Varying Fields, Maxwell's equation and pointing vector. Uniform plane wave and its transmission and reflection. Skin effect and Surface resistance. Wave guides. Introduction to radiation system.

CE 3100: Civil Engineering Drawing **Credits: 0.75**

Introduction, Scale drawing, Sectional drawing, Isometric drawing, Missing line, Auxiliary view. Detail and assembly drawing, Plane geometry, Pentagon, Hexagon, Octagon, Ellipse, Parabola, Hyperbola. Projection, Project on Engineering Drawing and CAD using AUTOCAD or contemporary packages instructed by the teachers. Plan, elevation and section of one-storied buildings.

ECE 3100: Software Development Project-II **Credits: 0.75**

Students will work in groups or individually to develop web-based applications and design a web site by adding client side and server-side scripting and interfacing the web applications to a database.

3rd Year Even Semester

ECE 3205: Industrial Electronics **Credits: 3.00**

Power semiconductor switches and triggering devices: BJT, MOSFET, SCR, IGBT, GTO, TRIAC, UJT and DIAC. Rectifiers: Uncontrolled and controlled single phase and three phases.
Regulated power supplies: Linear-series and shunt, switching buck, buckboost, boost and cuk regulators. AC voltage controllers, single and three phases. Choppers. DC motor control. Single phase cyclo converter.
Inverters: Single phase and three phase current and voltage sources. AC motor control. Stepper motor control. Resonance inverters. Pulse width modulation control of static converters.
Analog and Digital Power Devices: Sensors, Transducers, D/A interface, A/D interface, AD and DA converters related chips, High power devices.

ECE 3206: Industrial Electronics Sessional **Credits: 0.75**

Sessional based on the theory of course ECE 3205.

ECE 3207: Communication Engineering **Credits: 3.00**

Overview of Communication System: 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 signal to noise ratio. Communication systems: Analog and digital.
Continuous Wave Modulation: Amplitude, Angle Modulations & Demodulations, Sampling and Pulse Modulations-PAM, PWM, PPM, PCM, DM, line coding- formats and bandwidths.
Binary Modulated Band Pass Signaling: OOK, BPSK, DPSK, FSK, MSK bandwidth requirements, detection and noise performance, Multilevel Modulated Bandpass Signaling,
Multiplexing: TDM- principle, receiver synchronization, frame synchronization, TDM of multiple bit rate systems, FDM- principle, de-multiplexing, wavelength-division multiplexing multiple-access network- time-division multiple-access, frequency-division multiple access, code-division multiple-access - spread spectrum multiplexing, coding techniques and constraints of CDMA.
Communication system design: design parameters, channel selection criteria and performance simulation.

ECE 3208: Communication Engineering Sessional **Credits: 0.75**

Sessional based on the theory of course ECE 3207.

ECE 3221: Operating System **Credits: 3.00**

Introduction to operating system: Operating system concepts, its role in computer systems, computer system structure, fundamentals of different types of computer system, operating system structure and operation, protection and security.
Process management: Process concept, model and implementation, process state, process scheduling, inter-process communication (IPC), multiprocessing and time sharing, interaction between process and operating system,
CPU scheduling: Scheduling concepts, scheduling criteria, scheduling algorithms (SJF, FIFO, round robin, etc.).
Memory Management: Memory portioning, with and without swapping, virtual memory-paging and segmentation, demand paging, page replacement algorithms, implementation.
File systems: FS services, disk space management, directory and data structures.
Deadlocks and Case study: Modeling, detection and recovery, prevention and avoidance, Case study of some operating systems.
Others: Introduction to the different smart device Operating systems and their usage.

ECE 3222: Operating System Sessional **Credits: 0.75**

Sessional based on the theory of course ECE 3221.

ME 3219: Basic Mechanical Engineering **Credits: 3.00**

Study of fuels. Steam generation units with accessories and mountings. Study of steam generation and steam turbines. Introduction to internal combustion engines and their cycles. Study of SI and CI engines and gas turbines with their accessories. Refrigeration and air conditioning with their application. Refrigeration equipment: compressors, condensers and evaporators. Type of fluid machinery. Study of impulse and reaction turbine. Pelton wheel and Kaplan turbine. Study of centrifugal and axial flow machines. Pumps, fans, blowers and compressors. Study of reciprocation pumps.

ME 3220: Basic Mechanical Engineering Sessional **Credits: 0.75**

Sessional based on the theory of course ECE 3219.

Hum 3217: Economics & Accountancy **Credits: 3.00**

Economics: Nature of the economics theory applicability of economic theory to the problems of developing countries, some basic concepts supply, demand and their elasticity. Economics and technology. Producer's equilibrium-isoquant. Production - factors of production, production possibility curve-equilibrium of a firm, fixed cost and variable cost, laws of returns, internal and external economics and dis-economics, Input output analysis. Economic growth and economic development and planning basic concept-saving, investment, GNP, NNP, percapita income, growth rate, Fiscal policy, monetary policy and trade policy and their relative applicability in Bangladesh, Planning Five-year plans of Bangladesh, development problems related to agriculture. Industry and population of Bangladesh

Accountancy: Basic accounting principles, Objectives of Accounting, Transaction, Double Entry systems, Accounts and it's classification, Journals Cash book, Ledger, Trial Balance, Financial statement. Cost Accounts & objectives, Costs, Classification, Preparation of cost sheet, Cost volume profit (CVP) analysis, Standard costing, Process costing.

ECE 3200: Electrical Services Design **Credits: 1.50**

Introduction: Electrician's tools, splices, soldering, code practices. Electrical and electronic symbols, Safety rules, electricity rules and electricity codes. Terminology and definitions: fuses, circuit breakers, distribution boxes, cables, bus-bars and conduits. Wattage rating of common electrical equipment.

4th Year Odd Semester

ECE 4109: Power System **Credits: 3.00**

Basic Concepts: Inductance and Capacitance of overhead power lines, Line representation- equivalent circuit of short, medium and long line. Network representation: single line and reactance diagram of power system and per unit representation.

Load Flow Studies: Gauss – Seidel and Newton-Raphson method. Control of voltage, real and reactive power, reactive power compensation.

Fault Analysis: Symmetrical fault calculation, symmetrical components, sequence impedance and sequence networks, different unsymmetrical fault calculation, stability analysis.

MTE 4117: Control System and Robotics **Credits: 3.00**

Introductory Concepts: Open loop versus closed loop feedback system. Input output relationship. Transfer function. DC machine dynamics, performance criteria, sensitivity and accuracy. Analysis of control systems time and frequency domain error constants.

Stability of control system: Routh-Hurwitz criterion, bode plot, polar plot. Nyquist method. Root locus techniques. Frequency response analysis. Nicholes chart, compensation. Introduction to non-linear control system. State variable characterization of systems, transition matrix, canonical forms. Controllability and observability, PI, PD and PID controller.

Robotics: Definition, Scope and Trends of robotics, Classification of robots, Spatial descriptions and transformations, Kinematics of manipulators, Trajectory generation, Dynamics and Control of manipulators, Actuators and sensors for manipulators, Programming languages for robots, Mobile robots, Multi-robot systems Industrial robots, Service robots, Human-Robot Interaction, Social Robotics.

MTE 4118: Control System and Robotics Sessional **Credits: 0.75**

Sessional based on the theory of course MTE 4117.

ECE 4123: Digital Signal Processing **Credits: 3.00**

Introduction: Signals, systems and signal processing, classification of signals, the concept of frequency in continuous time and discrete time signals, analog to digital and digital to analog conversion, Sampling and quantization.

Discrete time signals and systems: Discrete time signals, discrete time systems, analysis of discrete time linear time invariant systems. Discrete time systems described by difference equations, implementation of discrete time systems, correlation and convolution of discrete time signals.

The z-transform: Introduction, definition of the z-transform, z-transform and ROC of infinite duration sequence, properties of z-transform inversion of the z-transform, the one-sided z-transform.

Frequency analysis of signals and systems: Frequency analysis of continuous time signals, Frequency analysis of Discrete time signals, Properties of Fourier transform of discrete time signals, Frequency domain characteristics of linear time invariant system, linear time invariant systems as frequency selective filters, Inverse systems and deconvolution.

Discrete Fourier Transform (DFT): Discrete Fourier series (DFS), Properties of DFS, Discrete Fourier
Transformation (DFT), Properties and application of DFT.
Fast Fourier Transform Algorithms: FFT algorithms, applications of FFT algorithm.
Digital Filter Design Techniques: Differential and difference equations, Digital Transfer Functions, frequency response, Digital filter realization scheme, Finite Impulse response (FIR) Infinite Impulse Response (IIR) filter design.
Application of DSP: Speech processing, analysis and coding, Matlab application to DSP

ECE 4124: Digital Signal Processing Sessional **Credits: 0.75**

Sessional based on the theory of course ECE 4123.

ECE 4000: Thesis/Project-I **Credits: 1.00**

A project/thesis course will be assigned to the students in 4th year odd semester class and it will continue till 4th year even semester. The objective is to provide an opportunity to the students to develop initiative, creative ability, confidence and precise 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. No grade shall be awarded for this course in 4th year odd semester. Final assessment on this course will be done in 4th year even semester.

ECE 4100: Industrial Training **Credits: 0.75**

Practical knowledge about industries that includes organizational structure, workflow, policies, rules and regulations, social responsibility, project management, team work, etc.

ECE 4122: Seminar **Credits: 0.75**

Practical knowledge about industries that includes organizational structure, workflow, policies, rules and regulations, social responsibility, project management, team work, etc.

4th year Odd Semester (Optional-I)

ECE 4111: Digital Communication **Credits: 3.00**

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 and maximum like hood 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.

ECE 4112: Digital Communication Sessional **Credits: 0.75**

Sessional based on the theory of course ECE 4111.

ECE 4115: Antennas & Propagation **Credits: 3.00**

Fundamental of Antennas: Vector Potential Functions, Electric and Magnetic Fields for Electric and Magnetic Current Sources, Solution of Vector Potential Wave Equation.
Antenna Arrays: Two-Element Array, N-element Linear Arrays: Broad-side, End-fire, Phased, Binomial, Dolph-Tchebyschef and Super-directive Arrays, Determination of Array Factor and Patterns, Planar and Circular Arrays. Travelling-Wave and Broad-band Antennas: Long wire, V, Rhombic and Helical Antennas, Yagi, Uda array, Frequency Independent and Log-periodic Antennas.
Perture, Reflector and Lens Antennas: Huygens's Principle, Rectangular and Circular Apertures, Microstrip Antennas, Babinet's Principle, Sectoral, Pyramidal and Conical Horns, Parabolic and Cassegrain Reflector Antennas, Lens Antennas. Antenna Measurement: Antenna ranges, Radiation Pattern, Gain. And Directivity, Polarization
Radio wave propagation: Ground wave propagation, Ionospheric propagation, Propagation losses.

ECE 4116: Antennas & Propagation Sessional **Credits: 0.75**

Sessional based on the theory of course ECE 4115.

ECE 4117: Radar and Satellite Communication **Credits: 3.00**

Radar: Introduction to Radar, Radar Equation CZ, Operating Principle of Radar with Block Diagram, CW and FM Radar, Tracking Radar, Antennas for Radar, Radar Receivers, Radar Transmitting System, Duplexer, and Usable Frequencies for Radar, Radar Applications.

Satellite Communication: Overview of Satellite System Engineering. Spacecraft, Introduction, to Spacecraft Subsystem. (AOCS), Telemetry, Tracking and command (TT & C). Spacecraft Antennas, Basic Antenna Types and Relationships Spacecraft, Antennas in Practice, Frequency Reuse Equipment Reliability and Space Qualification, Reliability redundancy. Multiple Access.

Earth station Technology: Earth Station Design, Earth Station Design for Low System Noise Temperature, Large Earth Station Antennas. Satellite Television Broadcasting Networks, VSAT technology.

ECE 4118: Radar and Satellite Communication Sessional **Credits:0.75**

Sessional based on the theory of course ECE 4117.

ECE 4125: Radio & TV Engineering **Credits: 3.00**

Introduction: Introduction to radio communication, History, Frequency management. Design of radio transmitter and receiver circuits using scattering-parameter methods. Circuits include oscillators, radio frequency amplifiers and matching networks, mixers and detectors. Design of amplitude, frequency, and pulse-modulated communication systems, including modulators, detectors, and the effects of noise.

Television: Introduction, principle of operation, transmitter and receiver, Receiving and transmitting antenna. Camera tube, Picture tube, Electron beam scanning, T-lines, balun, duplexer, Vestigial side-band filters. Introduction to color TV, VCR, CCTV, CATV, MATV, TV Booster.

ECE 4126: Radio & TV Engineering Sessional **Credits: 0.75**

Sessional based on the theory of course ECE 4125.

ECE 4141: Fiber Optic Communication **Credits: 3.00**

Introduction: Historical perspective, basic system, nature of light, advantages and applications of fiber optic.

Optics review: Ray theory and applications, lenses, imaging, numerical aperture, diffraction.

Light wave fundamentals: Electro magnetive waves, Dispersion, polarization, resonant cavities, reflection at plane boundary, critical angle. Integrated optic waveguides: Slab waveguide, Modes in symmetric and asymmetric waveguide, coupling, Dispersion and distortion, integrated optic components.

Optic fiber waveguide: Step index fiber, graded index fiber, attenuation, pulse

distortion and information rate, construction of optic fiber, optic fiber cables. Light sources: LED, LD, distributed feedback LD, optical amplifiers, fiber laser, vertical cavity surface emitting laser diode.

Light detectors: Photo detection, photo multiplier, semiconductor photodiode, PIN photodiode, avalanche photodiode.

Couplers and connectors: Connector principle, end preparation, splices, connectors, source coupling.

Network distribution and fiber components: Directional couplers, star couplers, switches, isolator, wave-length division multiplexing, fiber bragg grating.

Modulation: LED modulation, LD modulation, Analogue and digital modulation, modulation formats, optic heterodyne receivers.

Noise and detection: Thermal shot and noise, SNR, error rates, receiver circuit design. System design: Analogue and digital system design, few real-life problems and examples.

ECE 4142: Fiber Optic Communication Sessional **Credits: 0.75**

Sessional based on the theory of course ECE 4141.

ECE 4143: Biomedical Engineering **Credit: 3.00**

Introduction: Medical Terminology, Cell Physiology, Membrane Potential, Action Potential, Rhythmic Excitation of Heart. Transducers used in Medical Diagnostics.

Biomedical Instrumentation: Normal Electrocardiograph, ECG Simulator, Watch Filter, ECG Amplifier, Pulse Beat Monitor, Pace Maker, Galvanic Skin Resistance Detector, Respiratory and Suction Apparatus. Electronic Stethoscope. Electronic Clinical Thermometer, Blood Flow and Pressure Monitoring Recorders, Metabolic Rate Measurement.

Special topics: Bio-telemetry, Application of Ultrasonic and Laser in Biology and Medicine, Clinical X-ray Equipment. Fluoroscopy, Infrared Heating.

ECE 4144: Biomedical Engineering Sessional **Credits: 0.75**

Sessional based on the theory of course ECE 4143.

4th year Odd Semester (Optional-II)

ECE 4127: VLSI Design **Credits: 3.00**

VLSI Design Methodology: Top-down design approach, technology trends.
MOS Technology: Introduction to Microelectronics and MOS Technology, Basic Electrical Properties and Circuit Design Processes of MOS and Bi CMOS Circuits, MOS, NMOS, CMOS inverters, pass transistor and pass gates, DC and transient characteristics.
Overview of Fabrication Process: NMOS, PMOS, CMOS, Bi-CMOS process.
NMOS and CMOS Layout: Color plate Stick diagram, and design rules.
CMOS circuit characteristics: Resistance and capacitance, rise and fall time, power estimation.
Introduction to Bi-CMOS Circuits: Shifter, an ALU Sub-System, adder, counter, multipliers, multiplexer. Data Path and memory structures, Buffer circuit design, DCVS Logic.
Design and Test-Ability: Circuit partitioning, Floor planning and placement, Routing, Practical Aspects of Design Tools and Test-Ability MOS Design, Behavioral Description, Structural Description, Physical Description and Design Verification.

ECE 4128: VLSI Design Sessional **Credits: 0.75**

Sessional based on the theory of course ECE 4127.

ECE 4129: Network Planning **Credits: 3.00**

Introduction: Network components, Theoretical network, Real world networks.
Network Architectural Design: Designing the LAN, Configuring the network server and client, Network administration, Remote access, expanding the network, Wide area network troubleshooting, major protocol suites.
Network Simulation: Network simulation and optimization, Network operations, control and maintenance, Network administration, Network management database and tools, Capacity planning.
Network Optimization: Network security and integrity, linear programming and network algorithms for planning, Reliability theory and network planning.

ECE 4130: Network Planning Sessional **Credits: 0.75**

Sessional based on the theory of course ECE 4129.

ECE 4131: Wireless Network **Credits: 3.00**

Introduction to Wireless Networks: wireless access networks – wireless mesh networks, personal area networks (wireless sensor networks, body area networks, Low Pan, and Bluetooth), wireless and mobile ad hoc networks, challenged networks (DTNs, VANETs).
Wireless MAC Protocols: IEEE 802.11, IEEE 802.11e, IEEE 802.11n, IEEE 802.11s, IEEE 802.15.4, S-MAC, B-MAC, IEEE 802.22/20, IEEE 802.16d/e.
Wireless Routing: routing matrix – ETX, ETT, WCETT, Air Time Metric, routing protocols – AODV, DSR, DSDV, HWMP, sensor network routing, VANET routing etc.
Others: Wireless Transport protocols, Wireless TCP and its variants, Hop by Hop Congestion Control, Rate based Congestion Control etc. Quality of Service in Wireless Networks.

ECE 4132: Wireless Network Sessional **Credits: 0.75**

Sessional based on the theory of course ECE 4131.

ECE 4133: Artificial Intelligence **Credits: 3.00**

Fundamental: Definition of AI, historical development of AI, application of AI.
Production Systems: Introduction of product system, production rules, the working memory, the control unit interpretation, conflict resolution strategies, alternative approach for conflict resolution, types of production systems, forward versus backward production systems, knowledge base optimization in a production system.
General Problem-Solving Approaches: Breadth first search, depth first search, iterative deepening search, hill climbing, simulated annealing, heuristic search, A* algorithm, adversary search, the minimax algorithm, constraint satisfaction problems.
Logic and Structural Knowledge Representation: Propositional logic, first-order logic, resolution principle, frames, semantic-nets, petri nets, relational data model.
Reasoning under Uncertainty: Bayesian reasoning, fuzzy knowledge, probability theory, Dempster-shafer theory, fuzzy set theory, expert systems.
Machine Learning and Natural Language Processing: Naive Bayes algorithm, syntactic semantics and pragmatic, top-down passing, bottom-up pursing, lexicon.

ECE 4134: Artificial Intelligence Sessional **Credits: 0.75**

Sessional based on the theory of course ECE 4133.

ECE 4135: Human Computer Interaction **Credits: 3.00**

Process and Model: Introduction to Human-computer interaction (HCI), human information processing systems, Models of interaction, Approaches to HCI, User interface, HCI in software process, Cognitive models.

Issues and Requirements: Socio-organizational Issues and stakeholders Requirements, Communication and collaboration models, Task Analysis, Dialog notation and design, Groupware, CSCW and social issues.

User System Interaction: analysis and design, User interface design, Interface technique and technology, case studies.

ECE 4136: Human Computer Interaction Sessional **Credits: 0.75**

Sessional based on the theory of course ECE 4135.

4th Year Even Semester

ECE 4209: Power Station, Switchgear & Protection **Credits: 3.00**

Introduction to various power plants: Steam, hydro, gas, combined cycle, and nuclear power plants. Plant factor, load factor, diversity factor, load curve, chronological load curve, load duration curve. Base load and peak load, selection of units. Power plant economy.

Introduction to switchgear and protection: Fuse and Circuit breakers, principle of arc extinction in DC and AC circuit breakers. Recovery voltage, rate of rise of recovery voltage and other transient phenomena. Switching surges. Disconnection of unloaded transformer and transmission line. Speed of circuit breaker. Construction, operation, rating and testing of bulk oil and minimum oil breaker, SF_6 circuit breaker, ABCB, ACB, and VCB. Selection of circuit breaker. Travelling wave in transmission line. Surge absorber, lightning arrester, horn gap, its rating and testing.

Protective relaying: Relay voltage rating, high, medium and low. Basic protective zone. Relaying Scheme. Electromechanical Relays: Principal, general equation. Overcurrent, balanced current, overvoltage, distance, directional, positive sequence, negative sequence and differential relays and their applications.

Static relays: Introduction to solid state device in the construction of static relays. Different type of static relays.

Generator protection: Transformer protection, Bucholz's relay. Protection of bus bar, transmission line, feeder etc. Relay testing.

ECE 4211: Computer Networks **Credits: 3.00**

Introduction: Definition, uses of computer networks, network topology, network media, network devices, different type of networks: LAN, MAN, WAN etc.

IP Addressing: Classification of IP addressing, subnet mask, CIDR, private IP Address, public IP address, sub netting, VLSM etc.

Network Model: OSI Reference Model, TCP/IT Reference Model, ATM Reference Model, functions of the layers of different models, Network Protocols working at different layers.

Data Link Layer Design Issues and Framing: Character count, byte stuffing, bit stuffing, error detection: cyclic redundancy check, parity bit checking and correction: Hamming code, windowing protocols: go back N ARQ, selective repeat ARQ, elementary data link protocols, high-level data link control, point to point protocol, the medium access control sub-layer.

Multiple Access: Random Access, ALOHA, CSMA, CSMA/CD, CSMA/CA, channelized access, CDMA, TDMA, FDMA, controlled access, reservation, poling, token passing, Ethernet, wireless LANs and Bluetooth.

Switching: Circuit switching, packet switching, message switching, routing algorithms, virtual circuit and datagram, congestion control algorithms, quality of service, internetworking, internetworking devices etc.

Network Layer Protocols: Address resolution protocol, internet protocol, internet control, message protocol, ipv6, routing information protocol, open shortest path first, border gateway protocol, user datagram protocol, transmission control protocol.

Network Security: Cyber-attacks, Cyber-ethics, Cryptography, substitution cipher, transposition cipher, one-time pads, public key cryptography, encryption and decryption, authentication protocol 1.0 to 5.0, digital signature, key distribution center, different symmetric key algorithm, certificate authority, DNS, electronic mail, world wide web.

ECE 4212: Computer Networks Sessional **Credits: 0.75**

Sessional based on the theory of course ECE 4211.

ECE 4223: Digital Image Processing **Credits: 3.00**

Digital Image Fundamentals: Different types of digital images, sampling and quantization, imaging geometry, image acquisition systems.
Bilevel Image Processing: Basic concepts of digital distances, distance transform, medial axis transforms, component labeling, thinning, morphological processing, extension to grey scale morphology.
Binarization of Grey level images: Histogram of grey level images, optimal thresholding using Bayesian classification, multilevel thresholding.
Detection of edges: First order and second order edge operators, multi-scale edge detection, Canny's edge detection algorithm, Hough transform for detecting lines and curves, edge linking.
Images Enhancement: Point processing, Spatial Filtering, Frequency domain filtering, multi-spectral image enhancement, image restoration.
Image Segmentation: Segmentation of grey level images, Water shade algorithm for segmenting grey level image. Image representation and description, recognition and interpretation.
Image compression: Lossy and lossless compression schemes, prediction-based compression schemes, vector quantization, sub-band encoding schemes, JPEG compression standard, Fractal compression scheme, Wavelet compression scheme.

ECE 4224: Digital Image Processing Sessional **Credits: 0.75**

Sessional based on the theory of course ECE 4223.

ECE 4000: Thesis/Project-II **Credits: 3.00**

The objective is to provide an opportunity to the students to develop initiative, creative ability, confidence and precise 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.

4th year Even Semester (Optional-III)

ECE 4221: Unix Programming **Credits: 3.00**

Introduction: Introduction to Unix Programming.
Unix Environment: command line, globbing, I/O redirection, piping, Basic commands, Memory layout.
Debugging: GDB, valgrind, essential x86, Fork, exec, wait, Process status, bit manipulation, sending signals Unix I/O Implementing I/O redirection, piping Directories and files. Walking a directory tree, exploring attributes. Implementing ls -l. Permissions, file owner / group, time-stamps. Signals and signal handling Design / implementation of sleep Process Relationships Backgrounding. Popen/ pclose Midterm Terminal handling Review midterm Networking Client / Server. I/O multiplexing.
Multi-threading: basics, mutual exclusion Multi-threading: bounded buffers, condition variables Multi-threading: deadlocks Non-blocking I/O. Regular expressions. Sys V IPC. Semaphores and shared memory. Shell scripting

ECE 4222: Unix Programming Sessional **Credits: 0.75**

Sessional based on the theory of course ECE 4221

ECE 4227: Network Security **Credits: 3.00**

Introduction: Network security policies, strategies and guidelines, Network security assessments and matrices,
Different attacks: Denial of Service attack (DoS), Distributed Denial of Service (DDoS) attack, Eavesdropping, IP spoofing, Sybil attack, Blackhole attack, Grayhole attack, Man-in-the-middle attack, Passwords-based offline attacks,
Network security threats and attackers: Intruders, Malicious software, Viruses and Spy-ware, Security standards:
DES, RSA, DHA, Digital Signature Algorithm (DSA), SHA, AES, Security at Transport layer: Secure Socket Layer (SSL) and Transport Layer Security (TLS),
Security on Network layer: IPSec, Network security applications: AAA standards, e-mail securities, PGP, S/MIME, PKI smart cards, Sandboxing, Firewalls and Proxy server,
Security for wireless network protocols: WEP, WPA, TKIP, EAP, LEAP, Security protocols for Ad-hoc network, Security protocols for Sensor network, Security for communication protocols, Security for operating system and mobile agents, Security for e-commerce, Security for LAN and WAN, Switching and routing security, Other state of-the-art related topics.

ECE 4228: Network Security Sessional **Credits: 0.75**

Sessional based on the theory of course ECE 4227

ECE 4237: Parallel and Distributed Processing **Credits: 3.00**

Multithreaded computing: Basic concepts: processes, threads, scheduling, Multithreaded programming, Thread synchronization: semaphores, locks, monitors, Concurrency issues: deadlock, starvation, Multi-core computers.
Networked computers: Basic concepts: client-server, connections, datagrams, Application protocol design, Clientside socket programming, Server-side socket programming, Datagram programming.
Network protocols and security: Physical/data link/network/transport/application layers, Network security.
Distributed systems: Architectures: Two-tier, multi-tier, peer-to-peer, many-to-many, Middleware: distributed objects, web services.
Parallel computing: Architectures: SMP, cluster, hybrid, grid, GPGPU, Middleware: OpenMP, MPI, grid Middleware.

ECE 4238: Parallel and Distributed Processing Sessional **Credits: 0.75**

Sessional based on the theory of course ECE 4237.

ECE 4239: Computer Graphics and Animations **Credits: 3.00**

Introduction: History, Application of Computer Graphics (Computer Aided Design Animation), A Survey of Graphics I/O Devices and Types.
Graphics Software Design: Survey of Desired Function, Toward a Universal Graphic Language. Display Files, Databases for Pictorial Applications.
Graphics Techniques: Point-Plotting Techniques, Line Drawing, Geometric Transformations, Windowing and Clipping, Raster Graphics.
Hardware for Computer Graphics: Typical Small and Large System, Graphic Terminals, Plotters, Graphic Display Processors, Device Independent Graphics Systems.
Graphics Software: A Simple Graphic Package, Segmented Display Files, Geometric Models, Picture Structure.
Interactive Graphics: Input Techniques, Event Handling, Three-Dimensional Graphics, Curves and Surfaces, 3-D Transformation.
Hidden Surface Problem: Back Face Removal, Hidden-Line Removal Curved Surfaces, Describing Points, Lines and Polygons, Some Hints for Building Polygonal Models, Color Perception, RGBA and Color Index Mode, Dithering, Blending, 3-D Blending with The Depth Buffer, Antialiasing, Fog, Fog Equations, The OpenGL ARB.
API Specifies: Data Types, Function Naming Conventions, Platform Independence, Drawing Shapes with OpenGL, Animation with OpenGL and GLUT.
Drawing in Space: Lines, Points and Polygons.

Co-ordinate Transformations: Understanding Transformations, Matrix Munching Projections, Matrix Manipulation Color Lighting and Materials, Texture Mapping.

ECE 4240: Computer Graphics and Animations Sessional **Credits: 0.75**

Sessional based on the theory of course ECE 4239

ECE 4241: Computer Vision **Credits: 3.00**

Introduction: Introduction to Computer Vision, Case study-Face Recognition, Linear Algebra/Probability Review**.**
Image Structure: Linear Filters, Finding Lines-From Detection to Model Fitting, Clustering and Segmentation. Camera Models: Camera Models, Camera Calibration, Epipolar Geometry, Stereo & Multi-view Reconstruction.
Recognition (Building blocks): Detectors and Descriptors, SIFT & Single Object Recognition, Optical Flow & Tracking.
Recognition (Objects, Scenes, and Activities): Introduction to Object Recognition and Bag-of-Words Models, Object classification and detection- a part-based generative model (Constellation model), Object Classification and **Detection**: a Part-based Discriminative Model (Latent SVM), Human Motion Recognition.
Computer Vision: State-of-the-art and the Future.

ECE 4242: Computer Vision Sessional **Credits: 0.75**

Sessional based on the theory of course ECE 4241

ECE 4243: Data Mining **Credits: 3.00**

Data Mining and Applications: Relational Databases, Data Warehouses, Transactional Databases, Advanced Data and Information Systems, Characterization and Discrimination, Mining Frequent Patterns, Associations, and Correlations, Classification and Prediction, Cluster Analysis, Outlier Analysis, Evolution Analysis.
Data Preprocessing: Descriptive Data Summarization, Data Cleaning, Data Integration and Transformation, Data Reduction, Data Discretization and Concept Hierarchy Generation.
Classification, Clustering and Prediction: Classification by Decision Tree Induction, Bayesian Classification,
Rule-Based Classification, Classification by Back propagation, Support Vector Machines, Clustering by
Partitioning/ Hierarchical/ Density-based/ Grid-based/ Model-based methods,

Clustering High-Dimensional Data, Outlier analysis, Prediction, Linear Regression, Nonlinear Regression, Other Regression-Based Methods of prediction, Evaluating the Accuracy and error measures of a Classifier or Predictor.
Web Mining: Anatomy of a search engine, Crawling the web, Web Graph Analysis, Extracting structured data from the web, classification and vertical search, Web Log Analysis.
Advanced Analysis: Mining Stream, Time-Series, and Sequence Data, Graph Mining, Social Network Analysis, and Multi-relational data mining, Mining objects, Spatial, Multimedia, and Text Data.

ECE 4244: Data Mining Sessional **Credits: 0.75**
Sessional based on the theory of course ECE 4243.

ECE 4245: Machine Learning **Credits: 3.00**

Introduction to machine learning: Machine learning fundamentals, Logistic regression, linear regression Supervised and unsupervised classification, Performance evaluation techniques, bias-variance tradeoff, Applications of machine learning.
Machine Learning and Natural Language Processing: Naive Bayes algorithm, SVM, syntactic semantics and pragmatic analysis, top-down parsing, bottom-up parsing, lexicon analysis.
Concept of Neural Network: Introduction Human Brain Mechanism, Neural Machine Intelligence, Basic models of artificial neuron, activation function, network architecture, neural network viewed as directed graph, Basic learning rules, overview of perceptron, Single layer of perceptron, mathematical model of single layer perceptron, perceptron learning algorithm, Delta learning rule, Multi-layer perceptron, Back propagation learning algorithm, mathematical model of MLP network.
Fuzzy System & Defuzzification: Introduction to Fuzzy system, Fuzzy relations, fuzzy numbers, Linguistic description and their analytical form, fuzzy control, Defuzzification Methods, Applications, Concept of Neuro-Fuzzy and Neuro-GA Network.
Genetic Algorithm: Basic Concepts, Offspring, Encoding, Reproduction, Crossover, Mutation Operator, Application of GA.

ECE 4246: Machine Learning Sessional **Credits: 0.75**
Sessional based on the theory of course ECE 4245

4th year Even Semester (Optional-IV)

ECE 4247: Computer Aided Instrumentations **Credit: 3.00**

Introduction: Methods of measurement. Statistical method applied to field of measurement and error analysis and calibration.
Resistance, Inductance and Capacitance measurements: Different methods of measuring high, medium and low resistances. Methods of measuring self and mutual inductance and capacitance measurement. A.C. and DC bridge methods, Measurement of insulation and earth resistances. Localization of cable fault.
Magnetic measurement: Flux meter, Flux and Flux density measurement. Determination of iron losses and their separation.
Measuring instruments: Classification of measuring instruments. Ammeter, Voltmeter, wattmeter, AVO meter, Energy meter, Ampere-hour meter and Maximum demand meter for measuring AC and DC quantities. Speed, frequency and phase difference measurements. Illumination measurement.
Electronic measuring instruments: Digital instruments, VTVM, Q-meter and CRO.
Instrumentation: Extension of instrument range. Use of C.T. and P.T and calculation of their burden, Instrumentation of substation.
Measurement of non -electrical quantities: Transducer. Measurement of temperature, pressure, displacement, velocity, acceleration. Strain gauge and their applications.

ECE 4248: Computer Aided Instrumentations Sessional **Credits: 0.75**
Sessional based on the theory of course ECE 4247

ECE 4249: Computer Aided Power System Design **Credits: 3.00**

Network Matrices: Evaluation of Bus Admittance matrix (YUS), Bus Impedance matrix (ZBUS), Branch Impedance matrix (ZBT) and Loop Admittance matrix (ZLOOP) by singular and non-singular transformation using computer system.
Short Circuit Studies: Formulation of ZBUS for single phase and three phase networks, transformation of network matrices using symmetrical components, short circuit studies using computer.
Load Flow Studies: Representation of off load and on load tap changing and phase shifting transformer and dc link with computer tools, decoupled and fast decoupled methods, sparsity technique, introduction to load flow of integrated ac/dc/system.
Stability Studies: Network formulation for stability studies for different types of loads (constant impedance, constant current and constant power loads), digital computer solution of swing equation for single and multi-machine cases using Runge-Kutta and predictor corrector method, effect of exciter and governor on transient stability.

ECE 4250: Computer Aided Power System Design Sessional **Credits: 0.75**

Sessional based on the theory of course ECE 4249.

ECE 4251: Renewable Energy **Credits: 3.00**

Introduction: Importance of renewable energy, sources. Statistics regarding solar radiation and wind speed.
Insulation: Geographical distribution, atmospheric factors, measurements.
Solar cell: Principle of operation, spectral response, factors affecting conversion efficiency, I-V characteristics, maximum power output.
PV modules and arrays: Stationery and tracking.
PV systems: Stand alone, battery storage, inverter interfaces with grid.
Wind turbine generators: Types, operational characteristics, cut-in and cut-out speed, control, grid interfacings, AC-DC-AC link. Wind and Tidal energy conversion.
Other Non-conventional Energy Options: Geothermal, OTEC, Wave energy, Biomass, MHD, Chemical energy, Fuel cell, Nuclear fusion.

ECE 4252: Renewable Energy Sessional **Credits: 0.75**

Sessional based on the theory of course ECE 4251.

ECE 4253: Microwave Engineering **Credits: 3.00**

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

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

Microwave Tubes: Klystron amplifier, multicavity klystron amplifier, Reflex Klystron oscillator, magnetron, TWT amplifier, BWO. Semiconductor microwave devices: Tunnel diodes, Gunn-Effect diodes, IMPATT diodes. Microwave measurements.

ECE 4254: Microwave Engineering Sessional **Credits: 0.75**

Sessional based on the theory of course ECE 4253.

ECE 4255: Power System Operation & Control **Credits: 3.00**

Introduction: Design and constructional features of overhead power transmission lines and underground cables. DC and AC power distribution. Stability: Swing equation, power angle equation, equal area criterion, multi-machine system, step-

by-step solution of swing equation, factors affecting transient stability. Flexible AC transmission system. High voltage DC transmission system. Power system harmonics.
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.

ECE 4256: Power System Operation & Control Sessional **Credits: 0.75**

Sessional based on the theory of course ECE 4255.

ECE 4257: High Voltage Engineering **Credits: 3.00**

Ionization and decay process: Townsend's first and second ionization coefficient. Electric breakdown in gases.
Townsend's criterion for spark breakdown. Sparking potential. Penning effect. Corona discharges, power loss calculation. Breakdown of solid and liquid dielectrics.
Generation of high voltage: Alternating voltage, transformer cascade. Series resonant circuit for high voltage ac testing. Test of dc and ac cable.
Transient Voltage: Impulse wave shape. Impulse voltage generator and its mathematical analysis. Design consideration of impulse generators. Triggering of impulse generators.
DC Operation: DC voltage doubler and cascade circuits. Electrostatic generator, voltage stabilization. Measurement of high voltage. Electrostatic voltmeter, sphere gap. Potential divider. High Voltage testing of power system equipment. Oil testing. Design consideration of transmission line based on direct stroke. High voltage transient in transmission line. High voltage lightning arrester. Insulation co-ordination.

ECE 4258: High Voltage Engineering Sessional **Credits: 0.75**

Sessional based on the theory of course ECE 4257.

ECE 4259: System Simulation and Modeling **Credits: 3.00**

Simulation modeling basics: systems, models and simulation, Classification of simulation models, Steps in a simulation study.
Concepts in discrete-event simulation: event-scheduling vs. process-interaction approaches, time-advance mechanism, organization of a discrete-event simulation model, Continuous simulation models, Co3mbined discreet continuous models, Monte Carlo simulation, Simulation of queuing systems.

Building valid and credible simulation models: validation principles and techniques, statistical procedures for comparing real-world observations and simulated outputs, input modeling, Generating random numbers and random variates, Output analysis. Simulation languages, Analysis and modeling of some practical systems.

ECE 4260: System Simulation and Modeling Sessional **Credits: 0.75**

Sessional based on the theory of course ECE 4259.