

**Bachelor of Science
in
Electrical & Electronic Engineering
Program Booklet**



**Department of Electrical & Electronic Engineering
Rajshahi University of Engineering & Technology**

Issued to

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The information contained in this booklet is intended to provide guidance to those who are concerned with undergraduate study in Electrical & Electronic Engineering. No responsibility will be borne by the Department of Electrical & Electronic Engineering or the Rajshahi University of Engineering & Technology if any inconvenience or expenditure is caused to anyone because of the information in this booklet or any error in quoting the rules and regulations described herein. The information contained in it is subject to change at any time without any prior notification.

PREFACE

Department of Electrical & Electronic Engineering (EEE) of Rajshahi University of Engineering & Technology (RUET) offers both undergraduate and postgraduate programs. Both the undergraduate and the postgraduate programs are conducted based on the course system. The program syllabus and guidelines (rules and regulations) are incorporated in this booklet for information to present and prospective students and faculty members of this university.

The department produces competent engineers to meet the local and global technological challenges in EEE fields. It has highly qualified teaching staff and rich laboratory facilities. The EEE graduates of the department are among the technology leaders worldwide.

To maintain its leading position in generating technological leaders in EEE fields, it became essential to update the curriculum based on worldwide requirements. Therefore, a significant revision has been made in the syllabus contents to cater to recent advancements and developments in the field of Electrical & Electronic Technology. The new syllabus for the undergraduate program is divided into core and optional courses. The core courses (which contain departmental and related subjects) are mandatory for each and every student. The optional courses are divided into five groups, named Elective I, Elective II, Elective III, Elective IV, and Elective V, using four tracks: Power, Electronics, Communication, and Interdisciplinary. Students have to take course(s) from all groups. However, they have the freedom to choose courses from the groups according to their career goals.

Some general information about this university, its historical background, facilities, and information on the teaching department and the university administration have also been included herein. The students are advised to keep in touch with their course coordinator and department advisers to learn about any changes the authority makes.

October 2024

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Chapter 1

ABOUT THE UNIVERSITY

The University

RUET is one of the four leading universities for engineering education in Bangladesh. It is the second oldest of the type established in 1964 as the center of excellence for higher studies, research and development in engineering and technology in Bangladesh. It was first named as Engineering College, Rajshahi (ECR) in 1964, upgraded to Bangladesh Institute of Technology, Rajshahi (BIT Rajshahi) in 1986 and finally as a full fledged university in September 2003.

Location

The university is located in Motihar region of Rajshahi city. It is about five kilometers east from the city center and at the northern side of Rajshahi-Natore-Dhaka highway. The university has an ever-green campus having mango, lichi, coconut, black berry, and debdaru gardens on 152 acres of land.

The Campus

The RUET Campus is a picturesque with architecture and natural beauty. The campus area has been divided into different functional zones: (i) Residence for students, (ii) Residential zones for faculty and other supporting staff, (iii) Academic zone for academic buildings, laboratories, workshops, and (iv) Cultural cum social and recreational zones for students. A branch of Rupali Bank with an ATM booth, a post office, an auditorium, a central cafeteria, and a medical center are also located on the campus. There is Agrani School and College in the campus for facilitating education of the children of university employees. A shopping center is situated near the student dormitories to meet daily needs of the students. A barbar shop and a laundry are also situated at close proximity of the center.

Vision:

- To produce highly-skilled human resources through engineering and technology focused education and research in order to contribute to the socio-economic development of the country and beyond.

Mission:

- To produce technologically-sound professional human resources with high moral and ethical values in order to meet the demand of the society.
- To create a conducive environment to confirm high standard higher education, research and innovation in the area of engineering and technology.
- To create opportunities for multidimensional academic collaboration between universities, industries and professional organizations in higher education, research and innovation.
- To provide and receive on-demand advice and recommendation to solve scientific and technical issues at national and international level.
- To contribute in policy formulation in order to obtain sustainable socio-economic and industrial development of Bangladesh.

University Authority

The university has the following statutory committees for dealing student related affairs:

- 1) Syndicate
- 2) Academic Council
- 3) Dean's Executive Committee
- 4) Students Discipline Committee
- 5) Committee for Advanced Studies and Research (CASR)
- 6) Postgraduate Academic Committee (PGAC)
- 7) Undergraduate Academic Committee (UGAC)

ACADEMIC SUPPORT UNITS

Library Facilities

a) Central Library

The central library building is within the walking distance from the academic and residential buildings. It is a compact building with built-in facilities to provide the following services to the students and teachers.

- i) Acquisition and processing of books and other printed and electronic materials.
- ii) Issue and receipt of books.
- iii) Research aid and Journal section.
- iv) Reading room.

b) Rental Library

Each degree awarding department has its own rental library that provides books on rent to the students.

Students Health Service

An on campus medical center provides primary and basic health care facilities to the students (residential and non-residential) free of charges. Full-time MBBS doctors, nurses, and staffs provide these facilities to the students. For specialized consultation on complicated cases, the center refers the patients to specialist consultants.

Computer Center and Server Station

The central computer center plays an important role in the teaching and research of the students of different departments and provides useful services in data processing required in various sectors on national development. Each department also has separate computer laboratory where the students and the teachers of the respective departments can use computers for their thesis and research works. These computer centers are equipped with Pentium based machines operated under Windows and LINUX/UNIX operating system.

Directorate of Student Welfare

The Directorate of Student Welfare is responsible for various activities related to physical, mental, social, and other aspects for welfare of the students. These include regulating seat allocation process in the halls of residence, programs for physical education, games and sports, supervision of other co-curricular activities of students through the Central Students Union and through the student's union of the various halls of residence. It is also responsible for providing health services to the students, arranging career fair, employment for students and to organize and maintain contact with the alumni association of RUET, etc.

The Central Students Union, most of its members are elected by the students, bridges between students need and policy making authorities of the university. Unions of the various residential halls also arrange their

individual socio-culture activities, literary competitions etc. and help the hall authority in normal functioning of the halls.

Games and Sports Facilities

The sports center of RUET provides excellent facilities to students for acquiring physical fitness that is indispensable for a healthy mind and body. The institute maintains both outdoor and indoor gaming and gymnasium facilities for the students. There is a beautiful playground for outdoor games like football, volleyball and cricket, two tennis lawns and a basketball court. The center arranges a colorful athletic competition every year in the form of annual sports meet.

For improvement of the standard of games and sports, regular coaching by experts is arranged. The institute arranges inter-year, inter-departmental football, cricket, basket-ball and volleyball competitions. Teacher student friendly games are also arranged at occasions.

Students Halls of Residence

There are seven halls of residence at the campus. The total capacity of these halls is about 2100. Followings are the halls with their respective capacities. Some of the halls are named after the national Heroes, students of ECR, who have sacrificed their lives in the liberation war of Bangladesh in 1971 and legendary leaders of the country.

The existing capacity is around 40% of the total number of students of the university. Non-residential students are to be attached with a hall so that the administrative control on the students becomes easy.

Serial No	Name of the Halls	Residential 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

All halls are set in gardens and frontal green plantations and lawns and within easy walking distance of the academic buildings. The students live in these halls on community basis, while a single room depending on its size is shared by 2, 3 or 4 students. Each hall has a common room facility. A provost and few assistant provosts administrate each hall.

Auditorium Complex and Seminar Hall

The university has an Auditorium Complex with modern facilities having a seating capacity of about 720 which is capable of holding conference, seminar and other extracurricular activities. Beside this, there is an air-conditioned conference hall with capacity of 60 in the Academic Building I. In addition, major departments have their own seminar halls.

ACADEMIC FACULTIES AND DEPARTMENTS

The teaching departments are grouped in under four faculties. Presently there are 14 departments offering undergraduate degrees and 13 departments offering graduate/post graduate (Master/PhD) degrees. Departments under the faculty of applied science and engineering do not offer undergraduate programs. They only run post graduate programs and teach corresponding courses to undergraduate degree awarding departments.

Faculties

Faculty of Civil Engineering

- Department of Civil Engineering (CE)
- Department of Architecture (ARCH)
- Department of Urban & Regional Planning (URP)
- Department of Building Engineering & Construction Management (BECM)

Faculty of Electrical & Computer Engineering

- Department of Electrical & Electronic Engineering (EEE)
- Department of Computer Science & Engineering (CSE)
- Department of Electronics & Telecommunication Engineering (ETE)
- Department of Electrical & Computer Engineering (ECE)

Faculty of Mechanical Engineering

- Department of Mechanical Engineering (ME)
- Department of Glass & Ceramic Engineering (GCE)
- Department of Industrial & Production Engineering (IPE)
- Department of Mechatronics Engineering (MTE)
- Department of Materials Science & Engineering (MSE)
- Department of Chemical Engineering (CHE)

Faculty of Applied Science & Humanities

- Department of Mathematics
- Department of Physics
- Department of Chemistry
- Department Humanities

INSTITUTES

Rajshahi University of Engineering & Technology (RUET) hosts two prominent institutes dedicated to research and development in various engineering and technological fields. These institutes offer specialized platforms for students and faculty to engage in advanced research and academic pursuits.

Institutes

Institute of Information and Communication Technology (IICT)

Institute of Energy and Environmental Studies (IEES)

DEPARTMENT OF ELECTRICAL & ELECTRONIC ENGINEERING

The Department

The department buildings are located at the eastern side of the campus. It has one building. There are about 1000 students, 45 teachers, 28 officers and staffs. The department has both undergraduate and post graduate programs and awarding both the degrees regularly. It has sixteen well-established modern equipment enriched laboratories, a rental library for students where various departmental books and journals are available on rent, a conference hall, and several multimedia class rooms. It gives awards to outstanding students of the department including the Joynal Memorial Award of the university.

There is an association named Association of Electrical & Electronic Engineering in the department. All teachers and students of the department are members of the association. It arranges sports, seminars, and other co-curricular activities on behalf of the department. The department plays a vital role in solving/serving the local and national industrial problems/needs by providing testing and consulting facilities.

Vision of EEE:

To become a leading department of its kind and to produce globally competent humanitarian electrical and electronic engineers who will serve the needs and challenges of the society.

Mission of EEE:

- To educate students with the basic understanding of electrical and electronic engineering, and to develop their skills in the design and building of systems that directly impact local and global societal needs.
- To add and disseminate knowledge to the field through applied research and creation of department-industry collaboration.
- To produce graduates with high ethical standards and humanitarian qualities who are capable of taking leadership positions across the globe.
- To provide technical need-based consultancy services to the nation as well as services relating to technological policy making and their implementation for sustainable development.

Program Educational Objectives (PEOs) Statement:

PEOs	PEO Statement
PEO1	Graduates will function and advance as Electrical and Electronic Engineering professionals in academia, government, and industry by collaborating with stakeholders.
PEO2	Graduates will propose and implement efficient solutions to complex engineering problems associated with Electrical and Electronic Engineering by designing, selecting, and utilizing suitable and contemporary tools, skills, and technologies.
PEO3	Graduates will interact effectively and operate as valuable team players by upholding the highest ethical, professional, social values while preserving the environment.
PEO4	Graduates will procure leadership positions in industry and exercise entrepreneurial skills to inaugurate enterprises by providing innovative technological solutions and committing to life-long learning to address national and worldwide concerns.

Program Outcomes (POs) Statement and Mapping of PEOs and POs:

PO No.	PO Statement	PEO1	PEO2	PEO3	PEO4
a	Apply knowledge of mathematics, natural science, engineering fundamentals and an engineering specialization as specified in K1 to K4 respectively to the solution of complex engineering problems.	✓			
b	Identify, formulate, research literature and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences. (K1 to K4)		✓		
c	Design solutions for complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations. (K5)		✓		

d	Conduct investigations of complex problems using research-based knowledge (K8) and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions.		✓		
e	Create, select and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex engineering problems, with an understanding of the limitations. (K6)		✓		
f	Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice and solutions to complex engineering problems. (K7)	✓		✓	✓
g	Understand and evaluate the sustainability and impact of professional engineering work in the solution of complex engineering problems in societal and environmental contexts. (K7)			✓	✓
h	Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice. (K7)	✓		✓	
i	Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.	✓		✓	✓

j	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.				✓
k	Demonstrate knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	✓			
l	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	✓			

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Laboratory Facilities

The department provides adequate laboratories, library and other facilities to its members and students. The departmental undergraduate courses are augmented by intensive laboratory works in the name of sessional courses based on its theoretical parts and this requirement is catered by the following laboratories.

1. Computer Systems and Simulation Laboratory
2. Embedded System and Control Laboratory
3. Electrical Machines and Drives Laboratory
4. Electronics and Power Electronics Laboratory
5. Electrical Workshop and Design Laboratory
6. Fiber Optics and Photonics Laboratory
7. High Voltage and Switchgear Laboratory
8. Measurement and Instrumentation Laboratory
9. Microwave and Telecommunication Laboratory
10. Nanotechnology and Nanofabrication Laboratory
11. Renewable and Green Energy Laboratory
12. Radar and Satellite Laboratory
13. Firmware Engineering and IoT Laboratory
14. Biomedical Laboratory
15. Processing and Learning Laboratory
16. Solar Cell Testing Laboratory
17. Computational Photonics and Laser Laboratory

Electrical & Electronic Engineering Association

To facilitate academic and extra-academic activities of the students and teachers of the department there is an ‘Electrical & Electronic Engineering Association’ consisting of faculty members and students. The Association works under the direct supervision and guidance of the Head of the Department. The major source of the Association fund is contribution made by the department students and the teachers. The head of the department nominates one faculty member to act as honorary treasurer of the association.

Chapter 2

ACADEMIC ORDINANCE FOR THE UNDERGRADUATE PROGRAM

(Recommended by the 97th Academic Council held on 08/05/2019 and approved in 85th Syndicate Meeting held on 30/07/2019; Amendment at the 130th Academic Council held on 26/07/2022)

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 4th /5th 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 & 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 Engineering (CHE)
- 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 & Telecommunication Engineering
- vi) Department of Industrial & 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 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 Electronic & Telecommunication Engineering abbreviated as B.Sc. Engg. (ETE)
- vi) Bachelor of Science in Industrial & Production Engineering abbreviated as B.Sc. Engg. (IPE)
- vii) Bachelor of Science in Glass & Ceramic Engineering abbreviated as B.Sc. Engg. (GCE)
- viii) Bachelor of Science in Urban & Regional Planning abbreviated as BURP.
- ix) Bachelor of Science in Mechatronics Engineering abbreviated as B.Sc. Engg. (MTE)
- x) Bachelor of Science 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 Engineering abbreviated as B.Sc. Engg. (CHE)
- 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)
- xv) 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. Students shall be admitted into the 1st year class.

- 4.2. The Academic Council will form an Admission Committee in each academic session for admission into 1st year Bachelor Degree class.
- 4.3. 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.
- 4.4. 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.
- 4.5. 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.
- 4.6. 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.
- 4.7. 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.
- 4.8. 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.

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

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	14 Weeks
Mid-semester recess	1 Week
Recess before examination and Semester Final Examination	29 Days
Inter-Semester Recess	1 Week
Even Semester	Duration
Classes	14 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	0.75
	2 hours/week	1.00
	3 hours/week	1.50
	and similar	
iv. Project and 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 and 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 ($\sum C_i G_i$) accumulated up to the date by the total credit hours ($\sum C_i$). 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/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).

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 and 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 4th /5th 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 13th 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 (06).

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.

Script Evaluation:

1. There will be two sections in the questions and answer script. Each examiner will evaluate one section.
2. Examiners will send four copies of mark sheet along with marked answer script to the Chairman of Examination committee.
3. Chairman of the examination committee will send the answer script with mark sheet and questions to the scrutinizers for scrutiny.
4. Vice-Chancellor will appoint two Scrutinizers on recommendation from the Chairman of the examination committee.
5. 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.
6. Chairman of the examination committee will provide the three copies of scrutinized mark sheets to the tabulators/Data Entry Teachers.

7. Chairman of the examination committee will arrange examination committee meeting for result finalization.
8. Tabulation will be done at a secured place under the supervision of the chairman of the examination committee.
9. Proper security measure is required to be taken.
10. 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.
11. Controller of examination will publish the result after the approval of the Vice-Chancellor.
12. Grade sheets will be prepared and checked by the tabulators.

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 3

SYLLABUS FOR UNDERGRADUATE PROGRAM

Semester Credit Distribution and List of Courses

1. Introduction

To prepare students to meet their career objectives, the Electrical & Electronic Engineering curriculum is suggested to be composed of three stages of education:

- i. One and a half year of a combination of mathematics and basic sciences (some with experimental experience) appropriate to the discipline. The program must demonstrate that graduates have: knowledge of probability and statistics, including applications appropriate to the program name and objectives; and knowledge of mathematics through differential and integral calculus, basic sciences, computer science, and engineering sciences necessary to analyze and design complex electrical/electronic devices/communication technology, software, and systems containing hardware and software components, as appropriate to program objectives. If biomedical engineering considers as an area of concentration, an additional course (3 credit hours minimum) on biology must be included.
- ii. One and a half years of engineering topics, consisting of engineering sciences and engineering design appropriate to the student's field of study. The structure of the curriculum must provide both breadth and depth across the range of engineering topics implied by the title of the program.
- iii. A general education component that complements the technical content of the curriculum and is consistent with the program and institution objectives. Students take minimum six courses from Language, social science and humanities. In general, (i) one must be a first-year course in English Literature and Composition and Bangla; (ii) two or three courses from the list of social science courses, and (iii) one or two course from the list of approved humanities courses.

The curriculum must combine general education requirements, basic sciences, technical and professional requirements with electives to prepare students for a professional career and further study in the area of interest.

2. Categories of Courses

2.1. Language and General Education

2.1.1. Languages

Type	Description	Remarks
English	Composition, writing and Communication	Composition, writing and Communication
Bengali	Functional Bengali Language	Functional Bengali Language

2.1.2. General Education

Type	Description	Remarks
Social Science	Engineering Economics, Sociology, Financial and Managerial Accounting, Political Science, Environment and Society, Introduction to Human Development, Social Inequality and Planning, etc.	Compulsory: Ethics and environmental Protection (minimum 2 credit hours), History of Independence - (minimum 2 credit hours)
Arts and Humanities	Bangladesh Studies, International Relations, Ethics and Professionalism, history etc.	
Business	Business Communications, Industrial and Operational Management, Technology Entrepreneurship, business management, etc.	

2.2. Basic Sciences and Mathematics

2.2.1. Basic Sciences

Type	Description	Remarks
Physics	Topics: mechanics, Waves and Oscillations, electricity and magnetism, light and thermodynamics, modern and Quantum Physics, etc.	Course (courses) should be accompanied with appropriate laboratory work
Chemistry	Topics: Inorganic and Quantitative Analysis	

2.2.2. Mathematics

Type	Description	Remarks
Mathematics	Topics: differential and integral calculus, probability and statistics, complex variables, vector analysis, differential equations, linear algebra, etc.	Minimum four courses.

2.3 Other Engineering

Type	Description	Remarks
Computer Science and Engineering	Introduction to Computer fundamentals, Computer Methods in Engineering	Compulsory: One course from CSE
Mechanical Engineering	Mechanical Engineering fundamentals	
Industrial and Production Engineering	Industrial and Production engineering fundamentals etc.	

2.4. Program Courses

2.4.1. Core

Type	Description	Remarks
Power and Circuits a. Circuits b. Energy Conversion c. Power System	Electric Circuits (DC and AC), Energy Conversion, Introduction to Power System Analysis, Materials Sciences for Electrical Engineers, etc.	Compulsory: One course on circuits with laboratory work. One course on energy conversion
Electronics a. Circuits b. Devices c. Fabrication	Electronic Circuits, digital electronics /digital logic design, Fundamentals of semiconductor devices, semiconductor Physics, nanotechnology, Biomedical Electronics, etc.	Compulsory: One course on electronic circuits with laboratory work. One course on semiconductor devices or physics or technology.
Fields and Waves	Electric and Magnetic Fields, Fields Equations etc.	Compulsory: One course
Communication and Signal Processing	Communication Systems, Signals and Systems, digital communication, etc.	Compulsory: One course on signals and

		systems One course on communication system
Control Systems	Linear control	Compulsory: One course
Others	Microprocessors and Interfacing, Computer programming, etc.	Microprocessors and Interfacing is compulsory. Computer programming may be placed under other engineering category.
Project/Thesis/ Internship		Thesis/Project/Internship is compulsory

2.4.2. Technical Electives

Students will take at least two theories and one laboratory courses from her/his major area and three theories and one laboratory courses from other areas.

Type	Areas*
Technical Electives	Electric Power Electronics Communication Interdisciplinary

* University may consider areas outside those mentioned

Minimum credit hour requirement for awarding degree

Program	Minimum credit hour requirement for degree	
	Bi-Semester	
	15 weeks of classes + 60 minutes of classroom	14 weeks of classes + 50 minutes of classroom
B. Sc. in EEE	120	154

In other cases, the minimum credit hour requirement should be calculated applying the conversion rule.

Details of Undergraduate Courses

Semester Credit Distribution

S.N.	Year/ Semester	Theory		Sessional		Total Credits
		No of Course	Credits	No of Course	Credits	
1	1 st /Odd	5	15.00	4	4.50	19.50
2	1 st /Even	5	15.00	4	3.75	18.75
3	2 nd /Odd	5	15.00	4	3.75	18.75
4	2 nd /Even	5	15.00	3	4.50	19.50
5	3 rd /Odd	5	15.00	5	6.00	21.00
6	3 rd /Even	5	15.00	6	5.25	20.25
7	4 th /Odd	5	15.00	6	6.50	21.50
8	4 th /Even	5	15.00	5	5.75	20.75
Total		40	120.00	37	40.00	160.00

Summary of Undergraduate Course Plan

S.N.	Course Type	Credit	Percentage	
1	Departmental Courses			
	Core Courses	Theory	72.00	45.00
		Lab	31.00	19.38
	Elective Courses	Theory	15.00	9.38
		Lab	1.50	0.94
Sub-Total		119.50	74.70	
2	Related Courses			
	Humanities	Theory	6.00	3.75
		Lab	3.00	1.88
	Sub-Total		9.00	5.63
	Basic Sciences	Theory	18.00	11.25
		Lab	1.50	0.94
	Sub-Total		19.50	12.19
	Related Engg.	Theory	9.00	5.63
Lab		3.00	1.88	
Sub-Total		12.00	7.50	
Total		160.00	100.00	

List of Undergraduate Courses

Core Courses (EEE)

S.N.	Course Number	Course Title	Contact Hrs/Week	Credit
1	EEE 1101	Electrical Circuits I	3	3.00
2	EEE 1102	Electrical Circuits I Sessional	3	1.50
3	EEE 1201	Electrical Circuits II	3	3.00
4	EEE 1202	Electrical Circuits II Sessional	3/2	0.75
5	EEE 1203	Electronics I	3	3.00
6	EEE 1204	Electronics I Sessional	3	1.50
7	EEE 1205	Electrical Engineering Materials	3	3.00
8	EEE 2103	Electronics II	3	3.00
9	EEE 2104	Electronics II Sessional	3	1.50
10	EEE 2107	Electromagnetic Fields and Waves	3	3.00
11	EEE 2113	Digital Electronics I	3	3.00
12	EEE 2114	Digital Electronics I Sessional	3/2	0.75

S.N.	Course Number	Course Title	Contact Hrs/Week	Credit
13	EEE 2201	Signals and Linear Systems	3	3.00
14	EEE 2207	Electrical Machines I	3	3.00
15	EEE 2208	Electrical Machines I Sessional	3	1.50
16	EEE 2211	Measurements and Instrumentation	3	3.00
17	EEE 2212	Measurements and Instrumentation Sessional	3	1.50
18	EEE 2213	VLSI Circuits and Design I	3	3.00
19	EEE 2214	VLSI Circuits and Design I Sessional	3	1.50
20	EEE 3100	Electronics Shop Practice	3	1.50
21	EEE 3105	Control System Engineering	3	3.00
22	EEE 3106	Control System Engineering Sessional	3/2	0.75
23	EEE 3107	Electrical Machines II	3	3.00
24	EEE 3108	Electrical Machines II Sessional	3	1.50
25	EEE 3109	Computational Methods in Engineering	3	3.00
26	EEE 3110	Computational Methods in Engineering Sessional	3	1.50
27	EEE 3111	Power Systems I	3	3.00
28	EEE 3117	Communication Engineering I	3	3.00
29	EEE 3118	Communication Engineering I Sessional	3/2	0.75
30	EEE 3200	Technical Seminar	3/2	0.75
31	EEE 3202	Capstone Project Design I	3/2	0.75
32	EEE 3203	Power Electronics	3	3.00
33	EEE 3204	Power Electronics Sessional	3/2	0.75
34	EEE 3207	Digital Signal Processing	3	3.00
35	EEE 3208	Digital Signal Processing Sessional	3/2	0.75
36	EEE 3211	Power Systems II	3	3.00
37	EEE 3212	Power Systems II Sessional	3	1.50
38	EEE 3217	Communication Engineering II	3	3.00
39	EEE 3218	Communication Engineering II Sessional	3/2	0.75
40	EEE 4000	Project and Thesis	3	3.00
41	EEE 4002	Capstone Project Design II	3/2	0.75
42	EEE 4100	Electrical Services Design	3	1.50
43	EEE 4109	Microprocessors and Embedded Systems	3	3.00
44	EEE 4110	Microprocessors and Embedded Systems Sessional	3	1.50
45	EEE 4111	Power Plant Engineering and Economy	3	3.00
46	EEE 4116	Industrial Training	-	1.00
47	EEE 4211	Power System Protection and Switchgear	3	3.00
48	EEE 4212	Power System Protection and Switchgear Sessional	3/2	0.75
49	EEE 4217	Microwave Engineering	3	3.00
50	EEE 4218	Microwave Engineering Sessional	3/2	0.75
		Total		103.00

Core Courses (Humanities)

S.N.	Course Number	Course Title	Contact Hrs/Week	Credits
1	Hum 1111	Technical English	3	3.00
2	Hum 1112	Technical English Sessional	3/2	0.75
3	Hum 2100	History of Independence	3/2	0.75
4	Hum 3211	Financial Account and Economic Analysis	3	3.00
5	Hum 4212	Engineering Ethics, Sustainability and Innovation	3	1.50
Total			12	9.00

Core Courses (Mathematics)

S.N.	Course Number	Course Title	Contact Hrs/Week	Credits
1	Math 1101	Engineering Mathematics I	3	3.00
2	Math 1201	Engineering Mathematics II	3	3.00
3	Math 2101	Engineering Mathematics III	3	3.00
4	Math 2201	Engineering Mathematics IV	3	3.00
Total			12	12.00

Core Courses (Physics)

S.N.	Course Number	Course Title	Contact Hrs/Week	Credits
1	Phy 1111	Physics	3	3.00
2	Phy 1112	Physics Sessional	3/2	0.75
Total			4.50	3.75

Core Courses (Chemistry)

S.N.	Course Number	Course Title	Contact Hrs/Week	Credits
1	Chem 1211	Chemistry	3	3.00
2	Chem 1212	Chemistry Sessional	3/2	0.75
Total			4.50	3.75

Core Courses (ME)

S.N.	Course Number	Course Title	Contact Hrs/Week	Credits
1	ME 1200	Engineering Drawing	3/2	0.75
2	ME 2101	Basic Mechanical Engineering	3	3.00
3	ME 2102	Basic Mechanical Engineering Sessional	3/2	0.75
Total			6.00	4.50

Core Courses (CSE)

S.N.	Course Number	Course Title	Contact Hrs/Week	Credits
1	CSE 1111	Computer Programming	3	3.00
2	CSE 1112	Computer Programming Sessional	3	1.50
Total			6	4.50

Core Courses (IPE)

S.N.	Course Number	Course Title	Contact Hrs/Week	Credits
1	IPE 4111	Engineering, Management, Laws and Safety	3	3.00
		Total	3	3.00

Elective Courses

From 4th year odd semester, the department starts offering elective courses under four (4) tracks viz. Power-, Electronics, Communication and interdisciplinary track.

Track selection:

1. Students will be divided into three groups on the basis of courses offered by the department. For regular students, this will be done in 3rd year even semester.
2. A student will have to take five (5) elective courses along with the corresponding sessional courses from the respective elective track offered by the department.
3. Students will be assigned their projects/ theses in 4th year odd semester. The theme of project/thesis shall reflect the electrical & electronic engineering curricula.
4. Minimum class size of an elective course will be decided by the department.
5. In case of any unforeseen situation or ambiguity, the UGAC will take an appropriate decision.

Power Track

Sl. No.	Course Number	Course Title	Contact Hrs/Week	Credits
1	EEE 4141	Power System Stability and Control	3	3.00
2	EEE 4142	Power System Stability and Control Sessional	3/2	0.75
3	EEE 4143	High Voltage Engineering	3	3.00
4	EEE 4144	High Voltage Engineering Sessional	3/2	0.75
5	EEE 4145	Industrial Automation and Control	3	3.00
6	EEE 4146	Industrial Automation and Control Sessional	3/2	0.75
7	EEE 4147	Renewable Energy	3	3.00
8	EEE 4149	Special Machines and AC Drives	3	3.00
9	EEE 4241	Internet of Things	3	3.00
10	EEE 4242	Internet of Things Sessional	3/2	0.75
11	EEE 4243	High Voltage Transmission Systems	3	3.00
12	EEE 4244	High Voltage Transmission Systems Sessional	3/2	0.75
13	EEE 4245	Nuclear Power Engineering	3	3.00
14	EEE 4247	Smart Grids	3	3.00
15	EEE 4249	Power System Operation and Control	3	3.00
16	EEE 4251	Power System Reliability	3	3.00

Electronics Track

Sl. No.	Course Number	Course Title	Contact Hrs/Week	Credits
1	EEE 4161	Digital Electronics II	3	3.00
2	EEE 4162	Digital Electronics II Sessional	3/2	0.75
3	EEE 4163	VLSI Circuits and Design II	3	3.00
4	EEE 4164	VLSI Circuits and Design II Sessional	3/2	0.75
5	EEE 4165	Fabrication and Processing Technology	3	3.00
6	EEE 4166	Fabrication and Processing Technology Sessional	3/2	0.75
7	EEE 4167	Optoelectronics	3	3.00
8	EEE 4169	Analog Integrated Circuits	3	3.00
9	EEE 4261	Biomedical Signals, Instrumentation and Measurements	3	3.00
10	EEE 4262	Biomedical Signals, Instrumentation and Measurements Sessional	3/2	0.75
11	EEE 4263	Transducers and Instrumentation	3	3.00
12	EEE 4264	Transducers and Instrumentation Sessional	3/2	0.75
13	EEE 4265	Integrated Optics	3	3.00
14	EEE 4267	Semiconductor Devices Theory	3	3.00
15	EEE 4269	Photovoltaic System Design	3	3.00
16	EEE 4271	Compound Semiconductor Devices	3	3.00
17	EEE 4273	Nanotechnology and Nanoelectronics	3	3.00

Communication Track

Sl. No.	Course Number	Course Title	Contact Hrs/Week	Credits
1	EEE 4181	Digital Communication	3	3.00
2	EEE 4182	Digital Communication Sessional	3/2	0.75
3	EEE 4183	Information and Coding Theory	3	3.00
4	EEE 4184	Information and Coding Theory Sessional	3/2	0.75
5	EEE 4185	Mobile Cellular Communication	3	3.00
6	EEE 4187	Underwater Acoustic Signal Processing	3	3.00
7	EEE 4281	Antennas and Propagation	3	3.00
8	EEE 4282	Antennas and Propagation Sessional	3/2	0.75
9	EEE 4283	Radar and Satellite Communication	3	3.00
10	EEE 4284	Radar and Satellite Communication Sessional	3/2	0.75
11	EEE 4285	Optical Fiber Communication	3	3.00
12	EEE 4286	Optical Fiber Communication Sessional	3/2	0.75
13	EEE 4287	Multimedia Communication	3	3.00
14	EEE 4289	Wireless Communication	3	3.00
15	EEE 4291	Microwave Devices and Circuits	3	3.00
16	EEE 4293	Telecommunication Networks	3	3.00

Interdisciplinary Courses

Sl. No.	Course Number	Course Title	Contact Hrs/Week	Credits
1	EEE 4121	Introduction to Machine Learning	3	3.00
2	EEE 4122	Introduction to Machine Learning Sessional	3/2	0.75
3	EEE 4221	Artificial Intelligence and Advanced Machine Learning	3	3.00
4	EEE 4222	Artificial Intelligence and Advanced Machine Learning Sessional	3/2	0.75
5	EEE 4223	Robotics and Automation	3	3.00
6	EEE 4224	Robotics and Automation Sessional	3	0.75
7	EEE 4225	Advanced Embedded System Design	3	3.00
8	EEE 4226	Advanced Embedded System Design Sessional	3/2	0.75
9	CSE 4221	Computer Networks	3	3.00

Prerequisite Courses

Sl. No.	Course Number	Prerequisite Course Number
1	EEE 1201	EEE 1101, EEE 1102, EEE 1201
2	EEE 1203	EEE 1101
3	EEE 1205	EEE 1101, Phy 1111
4	EEE 2103	EEE 1203
5	EEE 2107	EEE 1101
6	EEE 2113	EEE 1203
7	EEE 2201	EEE 1101, Math 1201
8	EEE 2207	EEE 2107
9	EEE 2211	EEE1101, EEE 1201, EEE 1203
10	EEE 2213	EEE 1101, EEE1201, EEE1203, EEE 2103, EEE 2113, CSE 1111
11	EEE 3100	EEE 2103, EEE 2104, EEE 2203, EEE 2204
12	EEE 3105	EEE 2201
13	EEE 3107	EEE 1101, EEE 1102, EEE 2207
14	EEE 3109	Math 1101, Math 1201, Math 2101
15	EEE 3111	EEE 1201, EEE 2107, EEE 3105
16	EEE 3117	EEE 2107
17	EEE 3203	EEE 1101, EEE 1203
18	EEE 3207	EEE 2201, EEE 3109
19	EEE 3211	EEE 3111
20	EEE 3217	EEE 3117
21	EEE 4100	EEE 1102, EEE 2212
22	EEE 4109	EEE 2113
23	EEE 4111	EEE 3111, EEE 3211
24	EEE 4211	EEE 3111, EEE 3211
25	EEE 4217	EEE 2107

Semester Course Plan

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	EEE 1101	Electrical Circuits I	3	3.00			3.00
2	EEE 1102	Electrical Circuits I Sessional			3	1.50	1.50
3	CSE 1111	Computer Programming	3	3.00			3.00
4	CSE 1112	Computer Programming Sessional			3	1.50	1.50
5	Math 1101	Engineering Mathematics I	3	3.00			3.00
6	Phy 1111	Physics	3	3.00			3.00
7	Phy 1112	Physics Sessional			3/2	0.75	0.75
8	Hum 1111	Technical English	3	3.00			3.00
9	Hum 1112	Technical English Sessional			3/2	0.75	0.75
Total			15	15.00	9	4.50	19.50

1st Year Even Semester

Sl. No.	Course No.	Course Title	Theory		Sessional		Total Credits
			Contact Hrs/Week	Credits	Contact Hrs/Week	Credits	
1	EEE 1201	Electrical Circuits II	3	3.00			3.00
2	EEE 1202	Electrical Circuits II Sessional			3/2	0.75	0.75
3	EEE 1203	Electronics I	3	3.00			3.00
4	EEE 1204	Electronics I Sessional			3	1.50	1.50
5	EEE 1205	Electrical Engineering Materials	3	3.00			3.00
6	Chem 1211	Chemistry	3	3.00			3.00
7	Chem 1212	Chemistry Sessional			3/2	0.75	0.75
8	Math 1201	Engineering Mathematics II	3	3.00			3.00
9	ME 1200	Engineering Drawing			3/2	0.75	0.75
Total			15	15.00	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	EEE 2103	Electronics II	3	3.00			3.00
2	EEE 2104	Electronics II Sessional			3	1.50	1.50
3	EEE 2107	Electromagnetic Fields and Waves	3	3.00			3.00
4	EEE 2113	Digital Electronics I	3	3.00			3.00
5	EEE 2114	Digital Electronics I Sessional			3/2	0.75	0.75
6	Math 2101	Engineering Mathematics III	3	3.00			3.00
7	ME 2101	Basic Mechanical Engineering	3	3.00			3.00
8	ME 2102	Basic Mechanical Engineering Sessional			3/2	0.75	0.75
9	Hum 2100	History of Independence			3/2	0.75	0.75
Total			15	15.00	7.5	3.75	18.75

2nd Year Even Semester

Sl. No.	Course No.	Course Title	Theory		Sessional		Total Credits
			Contact Hrs/Week	Credits	Contact Hrs/Week	Credits	
1	Math 2201	Engineering Mathematics IV	3	3.00			3.00
2	EEE 2201	Signals and Linear Systems	3	3.00			3.00
3	EEE 2207	Electrical Machines I	3	3.00			3.00
4	EEE 2208	Electrical Machines I Sessional			3	1.50	1.50
5	EEE 2211	Measurements and Instrumentation	3	3.00			3.00
6	EEE 2212	Measurements and Instrumentation Sessional			3	1.50	1.50
7	EEE 2213	VLSI Circuits and Design I	3	3.00			3.00
8	EEE 2214	VLSI Circuits and Design I Sessional			3	1.50	1.50
Total			15	15.00	9	4.50	19.50

3rd Year Odd Semester

Sl. No.	Course No.	Course Title	Theory		Sessional		Total Credits
			Contact Hrs/Week	Credits	Contact Hrs/Week	Credits	
1	EEE 3100	Electronics Shop Practice			3	1.50	1.50
2	EEE 3105	Control System Engineering	3	3.00			3.00
3	EEE 3106	Control System Engineering Sessional			3/2	0.75	0.75
4	EEE 3107	Electrical Machines II	3	3.00			3.00
5	EEE 3108	Electrical Machines II Sessional			3	1.50	1.5
6	EEE 3109	Computational Methods in Engineering	3	3.00			3.00
7	EEE 3110	Computational Methods in Engineering Sessional			3	1.50	1.50
8	EEE 3111	Power Systems I	3	3.00			3.00
9	EEE 3117	Communication Engineering I	3	3.00			3.00
10	EEE 3118	Communication Engineering I Sessional			3/2	0.75	0.75
Total			15	15.00	12	6.00	21.00

3rd Year Even Semester

Sl. No.	Course No.	Course Title	Theory		Sessional		Total Credits
			Contact Hrs/Week	Credits	Contact Hrs/Week	Credits	
1	EEE 3200	Technical Seminar			3/2	0.75	0.75
2	EEE 3202	Capstone Project Design I*			3/2	0.75	0.75
3	EEE 3203	Power Electronics	3	3.00			3.00
4	EEE 3204	Power Electronics Sessional			3/2	0.75	0.75
5	EEE 3207	Digital Signal Processing	3	3.00			3.00
6	EEE 3208	Digital Signal Processing Sessional			3/2	0.75	0.75
7	EEE 3211	Power Systems II	3	3.00			3.00
8	EEE 3212	Power Systems II Sessional			3	1.50	1.50
9	EEE 3217	Communication Engineering II	3	3.00			3.00
10	EEE 3218	Communication Engineering II Sessional			3/2	0.75	0.75
11	Hum 3211	Financial Account and Economic Analysis	3	3.00			3.00
Total			15	15.00	10.50	5.25	20.25

*Capstone Project Design I: Students will attend this course throughout the 3rd year even semester and submit the project at the end of 3rd year even semester. The theme of project should reflect the knowledge gained from 1st year odd semester to 3rd year odd semester.

4th Year Odd Semester

Sl. No.	Course No.	Course Title	Theory		Sessional		Total Credits
			Contact Hrs/Week	Credits	Contact Hrs/Week	Credits	
1	EEE 4000	Project and Thesis			2	1.00	1.00
2	EEE 4002	Capstone Project Design II**			3/2	0.75	0.75
3	EEE 4100	Electrical Services Design			3	1.50	1.50
4	EEE 4109	Microprocessors and Embedded Systems	3	3.00			3.00
5	EEE 4110	Microprocessors and Embedded Systems Sessional			3	1.50	1.50
6	EEE 4111	Power Plant Engineering and Economy	3	3.00			3.00
7	IPE 4111	Engineering Management, Laws and Safety	3	3.00			3.00
8	EEE 4116	Industrial Training ***			-	1.00	1.00
9	EEE ****	Elective I	3	3.00			3.00
10	EEE ****	Elective I Sessional			3/2	0.75	0.75
11	EEE ****	Elective II	3	3.00			3.00
Total			15	15.00	11	6.50	21.50

**Capstone Project Design II: Students will attend this course throughout the 4th year odd and even semester and submit the project at the end of 4th year even semester. The theme of project should reflect the knowledge gained from 1st year odd semester to 4th year even semester.

***Industrial Training: Students will be attached with the industries/service agencies for two weeks after completion of their 3rd year even semester or during any vacation in 4th year odd semester to gain industrial experience.

4th Year Even Semester

Sl. No	Course No.	Course Title	Theory		Sessional		Total Credits
			Contact Hrs/Week	Credits	Contact Hrs/Week	Credits	
1	EEE 4000	Project and Thesis			4	2.00	2.00
2	EEE 4211	Power System Protection and Switchgear	3	3.00			3.00
3	EEE 4212	Power System Protection and Switchgear Sessional			3/2	0.75	0.75
4	EEE 4217	Microwave Engineering	3	3.00			3.00
5	EEE 4218	Microwave Engineering Sessional			3/2	0.75	0.75
6	Hum 4212	Environmental Ethics, Sustainability and Innovation			3	1.50	1.50
7	EEE ****	Elective III	3	3.00			3.00
8	EEE ****	Elective III Sessional			3/2	0.75	0.75
9	EEE ****	Elective IV	3	3.00			3.00
10	EEE ****	Elective V	3	3.00			3.00
Total			15	15.00	11.50	5.75	20.75

Elective Course Distribution

Elective I

Track	Course Number	Course Title	Credits
Power	EEE 4141	Power System Stability and Control	3.00
	EEE 4142	Power System Stability and Control Sessional	0.75
	EEE 4143	High Voltage Engineering	3.00
	EEE 4144	High Voltage Engineering Sessional	0.75
	EEE 4145	Industrial Automation and Control	3.00
	EEE 4146	Industrial Automation and Control Sessional	0.75
Electronics	EEE 4161	Digital Electronics II	3.00
	EEE 4162	Digital Electronics II Sessional	0.75
	EEE 4163	VLSI Circuits and Design II	3.00
	EEE 4164	VLSI Circuits and Design II Sessional	0.75
	EEE 4165	Fabrication and Processing Technology	3.00
	EEE 4166	Fabrication and Processing Technology Sessional	0.75
Communication	EEE 4181	Digital Communication	3.00
	EEE 4182	Digital Communication Sessional	0.75
	EEE 4183	Information and Coding Theory	3.00
	EEE 4184	Information and Coding Theory Sessional	0.75
Interdisciplinary	EEE 4121	Introduction to Machine Learning	3.00
	EEE 4122	Introduction to Machine Learning Sessional	0.75

Elective II

Track	Course Number	Course Title	Credits
Power	EEE 4147	Renewable Energy	3.00
	EEE 4149	Special Machines and AC Drives	3.00
Electronics	EEE 4167	Optoelectronics	3.00
	EEE 4169	Analog Integrated Circuits	3.00
Communication	EEE 4185	Mobile Cellular Communication	3.00
	EEE 4187	Underwater Acoustic Signal Processing	3.00

Elective III

Track	Course Number	Course Title	Credits
Power	EEE 4241	Internet of Things	3.00
	EEE 4242	Internet of Things Sessional	0.75
	EEE 4243	High Voltage Transmission Systems	3.00
	EEE 4244	High Voltage Transmission Systems Sessional	0.75

Electronics	EEE 4261	Biomedical Signals, Instrumentation and Measurements	3.00
	EEE 4262	Biomedical Signals, Instrumentation and Measurements Sessional	0.75
	EEE 4263	Transducers and Instrumentation	3.00
	EEE 4264	Transducers and Instrumentation Sessional	0.75
Communication	EEE 4281	Antennas and Propagation	3.00
	EEE 4282	Antennas and Propagation Sessional	0.75
	EEE 4283	Radar and Satellite Communication	3.00
	EEE 4284	Radar and Satellite Communication Sessional	0.75
	EEE 4285	Optical Fiber Communication	3.00
	EEE 4286	Optical Fiber Communication Sessional	0.75
Interdisciplinary	EEE 4221	Artificial Intelligence and Advanced Machine Learning	3.00
	EEE 4222	Artificial Intelligence and Advanced Machine Learning Sessional	0.75
	EEE 4223	Robotics and Automation	3.00
	EEE 4224	Robotics and Automation Sessional	0.75
	EEE 4225	Advanced Embedded System Design	3.00
	EEE 4226	Advanced Embedded System Design Sessional	0.75
	CSE 4221	Computer Networks	3.00
	CSE 4222	Computer Networks Sessional	0.75

Elective IV

Track	Course Number	Course Title	Credits
Power	EEE 4245	Nuclear Power Engineering	3.00
	EEE 4247	Smart Grids	3.00
Electronics	EEE 4265	Integrated Optics	3.00
	EEE 4267	Semiconductor Devices	3.00
	EEE 4269	Photovoltaic System Design	3.00
Communication	EEE 4287	Multimedia Communication	3.00

Elective V

Track	Course Number	Course Title	Credits
Power	EEE 4249	Power System Operation and Control	3.00
	EEE 4251	Power System Reliability	3.00
Electronics	EEE 4271	Compound Semiconductor Devices	3.00
	EEE 4273	Nanotechnology and Nanoelectronics	3.00
Communication	EEE 4289	Wireless Communication	3.00
	EEE 4291	Microwave Devices and Circuits	3.00
	EEE 4293	Telecommunication Networks	3.00

Details of Course Contents

Core Courses Offered by the Department of EEE

EEE 1101

Electrical Circuits I

Contact hours/week: 3

Credits: 3

Electrical Quantities and Circuit Variables: Charge, Current, Voltage, Power, Energy, Units of electrical quantities.

Fundamentals of Circuit Modelling: Independent, Dependent, Ideal- and practical sources, Combining sources in series, Parallel, Active and passive circuit elements, Ohm's law, Node, Branch, Loop, and Kirchhoff's laws.

AC Circuit Fundamentals: Sinusoidal waveforms, Average- and RMS values, Form factor, Peak factor, Response of resistor to sinusoidal signals.

Energy Storage Circuit Elements: Characteristics of inductance and capacitance, Response of inductor and capacitor to sinusoidal signals.

Phase Relationship and Phasor Representation: Phase relationship between a pair of signals, Voltage and current of inductor, Capacitor, and Resistor, Review of phasor algebra, Phasor representation of sinusoidal signals, Reactance, Susceptance, Impedance, and Admittance, Kirchhoff's laws in phasor domain, Phasor diagrams.

Circuit Reduction Techniques: Combining impedance in Series, Parallel, Series parallel, Voltage, and current divider rules, Concept of circuit equivalence, Y- Δ transformation, Source transformation, Voltage regulation.

Circuit Analysis Techniques: Solving ac and dc circuits using mesh current method, and node voltage method. **Circuit Theorems:** Tellegen's theorem, Superposition principle, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Millman's theorem, Substitution theorem, and Reciprocity theorem.

Powers in AC Circuit: Instantaneous power, Real, reactive, and complex power, Power factor, Conservation of AC power, Power factor correction, Maximum average power transfer theorem.

Resonance Phenomena: Series, and parallel resonance, Quality factor, Selectivity, and Bandwidth of resonant circuits.

Magnetic Circuits: Magnetic flux, and Flux density. Magnetic field, and Magnetic field intensity. Magnetomotive force and magnetizing force. Permeability, Reluctance, Electromagnet, Ampere's circuital law, Analysis of series, and series- parallel magnetic circuits.

EEE 1102

Electrical Circuits I Sessional

Contact hours/week: 3

Credits: 3/2

Sessional based on the theory of course **EEE 1101**.

CSE 1111**Computer Programming**

Contact hours/week: 3

Credits: 3

Introductory Concepts: Introduction to computers, Computer characteristics, Modes of operations, Type of programming language, Desirable program characteristics.

Flowcharts and Algorithm

C Fundamentals: The C character set, Identifiers and keywords, Data type, Constants, Variables, Declarations, Expressions, Statements and symbolic constants.

Operators and Expression: Arithmetic operators, Unary operators, Relational operators, Assignment operators, Conditional operators.

Data Input and Output: Preliminaries, Single character input and output, Other type of data input and output, String input and output, Interactive programming.

Control Statements: Preliminaries, Branching, Looping, Nested control statement, Switch, Break and continue statement, The comma operator.

Functions: Definition, Accessing a function, Function prototype, Passing arguments to a function, Recursion, Library function.

Program Structure: Storage classes, Automatic variables, External (global) Variables, Static variables, Multifile programs.

Array: Definition, Processing an array, Passing arrays to a function, Multidimensional arrays, Arrays and strings.

Pointers: Fundamentals, Pointer declarations, Passing pointer to functions, Pointer and one-dimensional array, Dynamic memory allocation, Operation on pointer, Arrays of pointers, Passing function to other function.

Structures and Unions: Defining a structure, Processing a structure, User-defined data types, Structure and pointer, Passing structures to functions, Self-referential structures, Union.

Data Files: Opening and closing a data file, Creating a data file, Processing a data file, Unformatted data files.

Basic Object-Oriented Programming: Introduction, Classes and objects, Features of object-oriented programming: Polymorphism, Function and operator overloading and inheritance.

Tools: C++ or others.

CSE 1112**Computer Programming Sessional**

Contact hours/week: 3

Credits: 3/2

Sessional based on the theory of course **CSE 1111**

Math 1101**Engineering Mathematics I**

Contact hours/week: 3

Credits: 3

Differential Calculus: Review of differentiation of various types of functions, Rolle's theorem, Mean value theorem, Partial differentiation, Euler's theorem, Tangent, Normal and curvature, Determination of maximum and minimum values of functions and their application, Series: Simple series divergency and convergency of geometric series: Maclaurin and Taylor series, Taylor's and Maclaurin's theorems in finite and infinite forms, Divergency and convergency of series.

Integral Calculus: Review of indefinite and definite integration of various types of functions, Revision of integration techniques: Integration by parts, by substitution and by partial fractions and others use of definite integration in summing series, Walli's formulae, Improper integrals, Beta function and gamma functions, Error function and their properties, Application of integration: 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 Equations: Ordinary differential equations: concept, order and role of conditions, First order linear equations with constant coefficients (emphasizing a complementary function/particular integral approach but making mention of integrating factors, Natural and forced response (including the case of resonance), Second order linear equations with constant coefficients, Characteristic polynomials, Mathematical and physical interpretation of solutions (time-constant etc).

Phy 1111**Physics**

Contact hours/week: 3

Credits: 3

Atomic Structure: Thompsons, Rutherford and Bohr's atomic model, Atomic arrangement in solid, Different types of bonds in solid-metallic, vander walls and ionic bond.

Electronic Structure of Materials: Free electron theory, Metallic conduction, Energy bands, Brillouin zones, Temperature dependence of metallic conductivity.

Semiconductors: Band theory, Intrinsic and extrinsic semiconductors, Fermi levels, Mobility and electrical conductivity, Carrier diffusion and life time.

Magnetic Materials: Properties of dia-, para- and ferro-magnetism, Hysteresis loop, B-H curve, Energy losses in magnetic materials and their measurements, Soft and hard magnetic materials, Ferrites.

Thermal Electricity: Thermocouple, Seebeck effect, Peltier and Thompson effect, Thermo-emf.

Photoelectricity: Laws of photoemission and Einstein's equation, Photoelectric cell and its use.

Sound: Simple harmonic motion, Wave equation, Principle of superposition, Beats, Dispersion, Phase and group velocities, Doppler's effect, Free and force vibrations.

Physical 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.

Phy 1112

Physics Sessional

Contact hours/week: 3/2

Credits: 3/4

Sessional based on the theory of course **Phy 1111**

Hum 1111

Technical English

Contact hours/week: 3

Credits: 3

Grammar: Grammatical principles, Modals, Phrases and idioms, Prefixes and suffixes, Sentence structures, WH and Yes/ No question, Conditional sentences.

Vocabulary: Technical and scientific vocabulary, Defining terms.

Spoken English: Introduction to phonetic symbols, Dialogue, Responding to particular situations, Extempore speech.

Reading: Comprehension of technical and non-technical materials skimming, Scanning, Inferring and responding to context.

Technical Writing: Paragraph/Essay writing on scientific and other themes, Report writing, Research paper writing, Library references.

Professional Communication: Business letter, Job application, Memos, Quotations, Tender notice.

Hum 1112

Technical English Sessional

Contact hours/week: 3/2

Credits: 3/4

Sessional based on the theory of course **Hum 1111**

EEE 1201

Electrical Circuits II

Contact hours/week: 3

Credits: 3

Analysis and Synthesis of Polyphase Balanced and Unbalanced Circuits: Introduction to poly-phase system, 3- ϕ power generation, Phase, Line, Neutral quantities and phase sequence. Balanced polyphase circuits analysis: Y-Y, Y- Δ , Δ - Δ , and Δ -Y. 3- ϕ power measurement, Comparison of copper among phases, Unbalanced system, Phase sequence Effect, and Checking, Unbalanced polyphase circuits analysis: Y-Y, Y- Δ using

Conventional Method and Millman's theorem, 3- ϕ power calculation and vector power factor.

First Order and Second Order Circuits: Transient and steady state analysis of first order and second order circuit using differential equation, Circle diagrams of series, parallel RL, RC, RLC, LC circuits.

Conductively and Magnetically Coupled Circuits: Terminology, Conception of mutual coupling, Coefficients of coupling with associated self and mutual parameters, Mutual inductance in series and parallel branches, Polarity test, Conception of transferred impedance, Energy in a coupled circuit and ideal transformers, Primary unity-power-factor and partial resonance, Double tuned circuit analysis.

Multiport Networks: Electrical network models – one - port elements, Impedance functions, Multi-port elements, Controlled sources, Matrix representations of multi-ports, Driving point impedances and network functions, Ladder and lattice networks, Passive versus active networks, Multi-stage modelling and design, Multi-port generalizations, Terminated multi-port networks, Network with controlled sources.

Filters: Introduction to filter, Classification of filter, Key terms related to filter, Passive filter, Different types of filter prototype, Double tuned filter, Cross-over circuit, Constant k filter, m-derived filter, Conventional analog filters analysis and design.

Scaling: Magnitude scaling, Frequency scaling, Magnitude and frequency scaling, Application of scaling concept in filter design.

Modelling and Simulation with Simulation Tools.

EEE 1202 Electrical Circuits II sessional

Contact hours/week: 3/2

Credits: 3/4

Sessional based on the theory of course **EEE 1201**

EEE 1203 Electronics I

Contact hours/week: 3

Credits: 3

Semiconductor Diodes: Overview on semiconductor diode, DC and AC equivalent circuits.

Diode Applications: Load-line analysis, Series diode configurations, Parallel and series-parallel configurations, and/or gates, Half-wave rectification, Full-wave rectification, Clippers, Clampers, Zener diode voltage regulators, Voltage-multiplier circuits.

Bipolar Junction Transistors: npn and pnp transistor construction and operation, Common-base configuration, Common-emitter configuration, Common-collector configuration, Limits of operation, Early effect, Transistor testing, Super beta transistor, Darlington pair.

Electrical conducting materials, Thermal properties, Thermal conductivity of metals.

Conducting Materials: Materials for electric resistors- general electric properties, Material for brushes of electrical machines, Lamp filaments, Fuses and solder.

Semiconductors: Classification of semiconductors: Intrinsic and extrinsic semiconductors, Fermi levels, Semiconductor conductivity, Temperature dependence, Carrier density and energy gap, Mobility and electrical conductivity, Carrier diffusion and lifetime, Trends in materials used in electrical equipment.

Superconductive Materials: Zero resistance and Meissner effect, Type I, and II superconductors, and critical current density, BCS theory, Magnetic recording materials, Josephson theory.

Dielectrics: Dielectric, Polarization under static fields, Electronic, Ionic, orientational, Interfacial, and dipolar polarizations, Behavior of dielectrics in alternating fields, Internal field, Clausius-Mossotti equation, Spontaneous polarization, Factors influencing dielectric strength and capacitor materials, Frequency dependence of dielectric constant, Complex dielectric constant, Dipolar relaxation and dielectric loss, Piezoelectricity, Ferroelectricity, Pyroelectricity.

Insulating Materials: Inorganic and organic materials, Resins and varnishes, Liquid insulators (transformer oil), Gaseous insulators (air, SF₆ and nitrogen) and ageing of insulators.

Piezoelectric Materials: Introduction properties and application of Piezoelectric materials, Electrostrictive materials, Ferromagnetic materials, Magnetostrictive materials, Shape memory alloys, Electro archeological fluids, Magneto archeological fluids, Smart hydrogels.

Meta-materials: Fundamentals of meta-materials, Material parameter extraction, Effective medium theory, Resonant unit cell analysis, and unit cell coupling.

Materials for Special Applications: Materials for solar cells, Fuel cells and battery, Materials for coatings for enhanced solar thermal energy collection and solar selective coatings, Cold mirror coatings, Heat mirror coatings, Antireflection coatings, and sintered alloys for breaker and switch contacts.

Modern Techniques for Materials Studies: Optical microscopy, Electron microscopy, Photo electron spectroscopy, Atomic absorption spectroscopy, magnetic resonance, Nuclear magnetic resonance, Electron spin resonance and ferromagnetic resonance.

Chem 1211

Chemistry

Contact hours/week: 3

Credits: 3

Chemical Bond: Ionic bond, Covalent bond, Co-ordination bond, Metallic bond, Hydrogen bond, Dipole bond, Vander Waal's forces, Hybridization,

Resonance, Valence bond theory, Molecular orbital theory, Linear combination of atomic orbital method.

Thermo-Chemistry: Types of energy, Enthalpy of reaction, Heat of combustion, Heat of formation and heat of neutralization, Experimental determination of thermal changes during chemical reaction.

Solution: Types of solution, Factors influencing the solubility of substance, Mechanism of dissolution, Solution of gases in liquids, Different units of concentration, Properties of dilute solution, Raoult's law-its application, Elevation of boiling point, Depression of freezing point and osmotic pressure.

Conductivity of Electrolytic Solution: Type of conductors, Conductance, Specific conductance, Equivalent conductance, Mechanism of electrolytic conductance, Factors influencing conductivity, Arrhenius theory, Law of independent migration of ions and its applications, Determination of transport number, Kohl-Rausch's law, Ionization of water and concept of pH, Abnormal conductance.

Electrochemistry: Electrochemical cell, Cell reaction, Cell potential, Cell representation, Measurement of emf of a cell, Relation between emf and free energy, Electrode potential, Electrochemical series, Nernst's equation, Different types of reference electrodes and pH measurement, Secondary cells or accumulators, Lead accumulator and alkaline accumulator.

Chemical Kinetics: Reaction rate, Units of rate, Rate laws, Order of a reaction, Zero order reaction, Molecularity of a reaction, Pseudo-order reactions, Zero order reactions, First order reactions, Second order reactions, Third order reactions, Units of rate constant, Half-life of a reaction, How to determine the order of a reaction, Effect of temperature on reaction rate, Activation energy, Le-Chatelier's theorem and some of its important industrial applications.

Acids and Bases: Arrhenius concept, Bronsted-Lowry concept, Strength of bronsted acids and bases, Lewis concept of acids and bases, Relative strength of acids, Calculation of K_a , Relative strength of bases, Calculation of K_b , Acid-base indicators, p^H range of indicators, Choice of a suitable indicator, Theories of acid-base indicators, Problems involving acid base titration.

Noble Gases: Introduction, Occurrence, Properties and uses of noble gases.

Chem 1212

Chemistry Sessional

Contact hours/week: 3/2

Credits: 3/4

Sessional based on the theory of course **Chem 1211**.

Math 1201**Engineering Mathematics II**

Contact hours/week: 3

Credits: 3

Vector Analysis: Review of vector algebra: Addition and subtraction of vectors, Scalar and vector product of two vectors and their geometrical interpretation, Triple products and multiple products, Linear dependents and independents of vectors, Vector calculus: Differentiation and integration of vectors together with elementary applications, Definition of line, Surface Volume integrals, Gradient of scalar function, Divergence and curl of vector functions, Various formulae: Green's theorem, Gauss's theorem, Stoke's theorem.

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

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

ME 1200**Engineering Drawing**

Contact hours/week: 3/2

Credits: 3/4

Introduction to Engineering Drawing: Principles of engineering graphics and their significance, Drawing Instruments and their use, Conventions in drawing, Lettering, Dimensioning rules, Geometrical construction.

Curves Used in Engineering Practice and Their Constructions: Conic sections, Special curves, Cycloids, Epicycloids, Hypocycloids.

Orthographic Projection: Principles of orthographic projections-conventions, First and third angle projections, Projections of points and lines inclined to both the planes.

Projections of Planes and Solids: Projections of regular planes, Inclined to both planes, Projections of regular solids inclined to both planes.

Development of Surfaces: Development of surfaces of right, Regular solids, Development of prisms, Cylinders, Pyramids, Cones and their parts.

Isometric Projections: Principles of isometric projections-isometric, Scale-isometric, Views, Conventions-plane figures, Simple and compound solids.

Transformation of Projections: Conversion of isometric views to orthographic views, Conversion of orthographic views to isometric projections, vice-versa, Machine drawings and technical sketching, Introduction to computer aided drawing.

EEE 2103**Electronics II**

Contact hours/week: 3

Credits: 3

Power Amplifiers: Classes of power amplifier, Series-fed class A amplifier, Transformer-coupled class A amplifier, Class B amplifier operation, Class B amplifier circuits, Amplifier distortion, Power transistor heat sinking, Class C and class D amplifiers.

BJT and JFET Frequency Response: Low-frequency analysis—Bode plot, Amplifier transfer function, Low-frequency response—BJT and FET amplifier, Miller effect capacitance, High-frequency response—BJT and FET amplifier, Frequency response of cascaded amplifiers.

Operational Amplifier: Block diagram and circuit diagram of practical Op-Amp, Parameters and characteristics of Op-Amp, Differential and common-mode operation, and Multistage Op-Amp amplifier.

Operational Amplifier Applications: Inverting amplifier, Non-inverting amplifier, Summing amplifier, Differentiator, Integrator, Voltage follower, Differential amplifier, Logarithmic amplifier, Exponential amplifier.

Practical Operational Amplifier: Comparison of ideal and practical op-amp, Input offset voltage, Offset voltage compensation, Input bias current, Input offset current, error voltage, Noise, CMRR and their significance in practical circuit.

Operational Amplifier with Feedback: Feedback concept and connection types, Improvement of amplifier characteristics by negative feedback, Practical feedback circuits, Feedback amplifier—phase and frequency considerations.

Wave Shaping: Linear and non-linear wave shaping, Frequency response of waves shaping circuits, Non-linear function circuits, Negative resistance devices.

The 555 Timer: Functional block diagram, Monostable, Astable multivibrator.

Phase-lock loop, Voltage-controlled oscillators.

Oscillator Circuits: Oscillator operation, Phase-shift oscillator, Wien bridge oscillator. Tuned oscillator circuits- Hartley oscillator, Colpitts oscillator, Crystal oscillator.

Active Filter: Active filter with Op-Amp, Butterworth filter, Butterworth design using Sallen-Key circuit.

EEE 2104**Electronics II Sessional**

Contact hours/week: 3

Credits: 3/2

Sessional based on the theory of course **EEE 2103**.

EEE 2107

Electromagnetic Fields and Waves

Contact hours/week: 3

Credits: 3

Review of vectors and coordinate systems.

Static Electric Field: Coulomb's law and electric field, Gauss' law and Divergence of electric flux density, Work, Potential, Potential gradient and Energy in electrostatic field, Current and current density, Conductor, Dielectrics, Boundary conditions, Capacitance, Laplace's and Poisson's equations.

Steady State Magnetic Field: Steady magnetic field, Biot-Savart law, Ampere's law, Curl of H, Stoke's theorem, Magnetic boundary conditions, Magnetic material and boundary conditions, Magnetic flux density, Vector magnetic potential, Inductance.

Time Varying Fields: Faraday's law, Displacement current density, Maxwell's equations in differential and integral form, Retarded potential.

Plane Wave Propagation: Plane wave in free space, Perfect dielectric, Lossy dielectrics, Good conductors, Loss tangent and skin effect, Poynting theorem, Power density, Polarization of plane wave, Wave propagation in periodic structures and photonic bandgaps.

Reflection: Reflection from perfect conductors, Reflection from perfect dielectrics.

Introduction to Radiating Systems.

Waveguides: General formulation, Modes of propagation and losses in parallel plate, Rectangular and circular waveguides.

EEE 2113

Digital Electronics I

Contact hours/week: 3

Credits: 3

Introduction to number systems and codes.

Analysis and Synthesis of Digital Logic Circuits: Boolean algebra, De Morgan's law, logic gates and truth tables, Combinational logic design, Minterms and sum-of-products, Maxterms and product of sums, Don't care terms, Cost of implementation, Minimization of combinational logic, Algebraic logic Reduction, Karnaugh Map - implicants, Prime implicants, Essential prime implicants. Multi-level logic functions - Multiplexer, Demultiplexer, Encoder, Decoder, Adder and subtractor. Reduced dimension maps - map-entered variables; Quine-Mccluskey logic reduction - prime implicant table, Mixed logic.

Introduction to Verilog hardware description language programming and structural and behavioral design of digital systems using Verilog HDL, Verilog timing analysis and test bench.

Hazards in Asynchronous Sequential Circuits: Static, Dynamic and essential hazards.

MOSFET Digital Circuits: NMOS inverter, CMOS inverter, CMOS logic circuits, Clocked CMOS logic circuits, Transmission gates, Sequential logic

circuits, BJT digital circuits: ECL, TTL, STTL, BiCMOS, Memories: classifications and architecture, RAM memory cells, Read only memory.

Modular Combinational Circuit Design: Pass transistor, Pass gates, Multiplexer, Demultiplexer and their implementation in CMOS, Decoder, Encoder, Comparators, Binary arithmetic elements and ALU design.

Programmable Logic Devices: Logic arrays, Field programmable logic arrays and Programmable read only memory.

Sequential Logic Circuit Design: Different types of latches, Flip-flops and their design using ASM approach, Timing analysis, and Power optimization of sequential circuits.

Modular Sequential Logic Circuit Design: Shift registers, Counters and their applications, Asynchronous and synchronous sequential circuits.

Finite State Machines Design: Architecture; Mealy and Moore state machines; Logic synthesis- state diagram, State table, State reduction, State assignment, Next-state and output functions; State machine diagram; Metastability- setup and hold implementation of simple FSM using field programmable logic device.

ADC/DAC: Functional block diagram, Flash ADC, Successive approximation ADC, Dual slope ADC, Sigma Delta ADC, Binary weighted DAC, R-2R ladder, Error: Quantization error, DNL, INL.

EEE 2114 Digital Electronics I Sessional

Contact hours/week: 3/2

Credits: 3/4

Sessional based on the theory of course **EEE 2113**.

Math 2101 Engineering Mathematics III

Contact hours/week: 3

Credits: 3

Partial Differential Equations: 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); Standard forms $f(p,q)=0$, $z=px+qy+f(p,q)$, $f(p,q,z)=0$, $f_1(x,p)=f_2(y,q)$, 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.

Matrix: Definition of matrix, Different types of matrix, Algebra of matrix, Adjoin and inverse of a matrix, Elementary transformations of matrix, Matrix polynomials, Calay-Hamilton theory with uses of rank and nullity, Normal and canonical forms, Solution of linear equations, Eigenvalues and eigenvectors.

Series Solution: Solution of differential equations in series by the method of Frobenius, Bessel's functions, Legendre's polynomials and their properties.

3D Geometry: Co-ordinate geometry of three dimension- System of co-ordinates, Concept of rectangular- cylindrical and spherical co-ordinate system,

Transformation of co-ordinates, Distance between two points, Section formula, Projection, Direction cosines, Equations of planes and lines.
Application to electrical systems.

ME 2101 Basic Mechanical Engineering

Contact hours/week: 3

Credits: 3

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 2102 Basic Mechanical Engineering Sessional

Contact hours/week: 3/2

Credits: 3/4

Sessional based on the theory of course **ME 2101**.

Hum 2100 History of Independence

Contact hours/week: 3/2

Credits: 3/4

Description of the Country and Its People: Geographical features and their influence, Ethnic composition, Language, Cultural syncretism and religious tolerance, Distinctive identity of Bangladesh in the context of undivided Bengal

Proposal for Undivided Sovereign Bengal and the Partition of the Sub Continent, 1947: Rise of communalism under the colonial rule, Lahore resolution of 1940, The proposal of Suhrawardy and Sarat Bose for sovereign undivided Bengal, consequences, The creation of Pakistan in 1947

Pakistan: Structure of the State and Disparity: Central and provincial structure, Influence of military and civil bureaucracy, Economic, social and cultural disparity

Language Movement and Quest for Bengali Identity: Rule by Muslim League and struggle for democratic politics, Foundation of Awami League, 1949, The Language Movement: context and phases, United front of Haque - Bhasani - Suhrawardy: elections of 1954, consequences

Military Rule: The Regimes of Ayub Khan and Yahya Khan (1958-1971): Definition of military rule and its characteristics, Ayub Khan's rise to power and characteristics of his rule (Political repression, Basic

Democracy, Islamisation), Fall of Ayub Khan and Yahya Khan's rule, Abolition of one unit, Universal suffrage, The legal framework order

Rise of Nationalism and the Movement for Self-determination:

Resistance against cultural aggression and resurgence of Bengali culture, The Six Point Movement of Sheikh Mujibur Rahman, Reaction, importance and significance of the Six Point Movement, The Agartala Case of 1968

The Mass Uprising of 1969 and the 11 Point Movement: Background, Programme, significance and consequences, Election of 1970, Non-cooperation movement and The declaration of independence by Bangabandhu, Election result and center's refusal to comply, The non-cooperation movement, the 7th March address of Bangabandhu, Operation Searchlight, Declaration of independence by Bangabandhu and his arrest

The War of Liberation 1971: Genocide, repression of women and refugees, Formation of Bangladesh Government and proclamation of independence, The spontaneous early resistance and subsequent organized resistance (Mukti Fouz, Mukti Bahini, Guerillas and The frontal warfare), Publicity campaign in the war of liberation (Shadhin Bangla Betar Kendra, the campaigns abroad and formation of public opinion), Contribution of students, women and the masses (People's war), The role of super powers (USSR, USA and China) and the Muslim states in the liberation war, The anti-liberation activities of the occupation army, the Peace Committee, Al-Badar, Al-Shams, Razakars, Pro-Pakistan political parties and Pakistani collaborators, killing of the intellectuals, Trial of Bangabandhu in jail in Pakistan and reaction of the world community, Role of the Bengalis living abroad and the civil societies of different countries of the world, The contribution of India in the Liberation War, Formation of joint Indo-Bangladesh command and the victory, The overall contribution of Bangabandhu and his leadership in the independence struggle

The Bangabandhu Regime 1972-1975: Homecoming, Making of the constitution, Reconstruction of the war-ravaged country, foreign policy, The murder of Bangabandhu and his family and the ideological turn-around.

Math 2201

Engineering Mathematics IV

Contact hours/week: 3

Credits: 3

Complex Variable: Complex number system, General functions of a complex variable, Limits and continuity of a function of complex variable and related theorems; Complex differentiation and the Cauchy-Riemann equations, Mapping by elementary functions, Line Integral of a complex function, Cauchy's Integral theorem, Cauchy's Integral formula, Liouville's theorem, Taylor's theorem and Laurent's theorem, Singular points, Residue, Cauchy's Residue theorem, Evaluation of residues, Contour integration, Conformal mapping.

Statistical Analysis: Review of Mean, Median, Mode and other measures of central tendency, Standard deviation and other measures of dispersion,

Moments skewness and kurtosis, Elementary probability theory, discrete probability distributions (Binomial and Poisson) and continuous probability distributions (Normal distribution), Characteristics of distributions.

Statistical Properties of Random Variable, Vector and Matrix: PDF, CDF and MGF of continuous and discrete random variables, Marginal PDF and joint PDF of continuous and discrete random variables, Joint PDF of two independent random variables, Joint PDF of two dependent random variables, Calculation of PDF of a vector from the PDF of its element, Calculation of PDF of a matrix from the PDF of its element, Hypothesis testing and regression analysis.

EEE 2201

Signals and Linear Systems

Contact hours/week: 3

Credits: 3

Signals: Continuous and discrete time signals and their properties, Important Signal Types, Operations and models, Laplace, Fourier and Z transforms and their properties, Signal reconstructions, Sampling, Nyquist sampling theorem, Aliasing effect, Fourier series representation of periodic signals.

System: Classifications of system; Representation of systems by block diagrams, Differential and difference equations for LTI systems, State space representations, Modelling of electrical, Mechanical and electromechanical system, Transfer functions of LTI systems, Pole-zero diagram and system stability, Realization of system using direct, cascade, and parallel forms, Interconnection of system, Basic feedback system; Inverse system, Distortion less system.

System Response: Time domain and frequency domain analysis of LTI systems, First order and second order system response, First order and second order switching circuit, Application of first order and second order system, Zero-input and zero-state response, Transient and steady-state response, Forced and natural response, Impulse and step responses, Convolution integral and application to LTI system, Network Synthesis, Parseval's theorem.

Filters: Analog filter design, Low pass prototypes of modern filters, Filter design and transformations; Realisation of passive filter circuits; Active filters, First and second order transfer functions, Realization of higher order filters.

Application of Signals and Systems in Communication: Signal and carrier, Bandwidth and spectrum allocation, Modulation schemes: AM, FM and PM, Modulators and demodulators, Time division and Frequency division multiplexing.

EEE 2207**Electrical Machines I**

Contact hours/week: 3

Credits: 3

Principles of electromechanical energy conversion, Energy stored in magnetic field, Field energy in a magnetically linear system, Singly excited system and doubly excited system, Basic concepts of rotating electric machines, Basic structure of rotating electric machines, MMF space wave of a concentrated coils, MMF of distributed single-phase winding, MMF of three-phase windings, Rotating magnetic field, Generated voltage in AC machines, Machine torque, Torque in machines with cylindrical air gaps, Reluctance torque or alignment.

Transformers: Ideal transformer- transformation ratio, No-load and load vector diagrams; Actual transformer- equivalent circuit, Regulation, Short circuit and open circuit tests. Transformer-tests. Auto-transformer and instrument transformers: (C.T. and P.T.), Parallel operation of transformers. Three phase transformer and its connections; Vector group of three phase transformers; Phase conversion.

DC Generators: Overview of construction, Types of DC machines, Equivalent circuit of a DC generator, Lap and wave windings, EMF equation of DC machines, Armature reaction in DC generators, Commutation and methods of improving commutation, Characteristics of DC generators, Separately excited DC generator, Voltage build-up in self-excited generator, DC shunt, DC series and DC compound generator characteristics, Parallel operation of DC generators.

DC Motors: Working principle of motor, Back E.M.F., Types of DC motors, Equivalent circuit of a DC motor, Torque of DC motor, Armature reaction in DC motor, Characteristics of a DC shunt motor, Characteristics of a DC series motor, Characteristics of a DC compound motor, Speed of a DC machine, Speed control of DC motors, Starting of DC motors, Three point and four point starter with its advantages and disadvantages,

Losses in DC machines, Power flow diagram, Testing of DC machines, Swinburne's test, Hopkinson's test, Break and pulley test, Regenerative test

Special Machines: Brushless DC motor, Welding machine, Universal motor, Stepper motor, Reluctance motor, Repulsion motor, Servomotor, Hysteresis motor, Permanent magnet motor and Electrostatic motor.

EEE 2208**Electrical Machines I Sessional**

Contact hours/week: 3

Credits: 3/2

Sessional based on the theory of course **EEE 2207**.

EEE 2211 Measurements and Instrumentation

Contact hours/week: 3

Credits: 3

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

Static Performance of Instruments: Errors and uncertainties, Propagation of uncertainties, Accuracy, Precision, Resolution, Linearity, etc., Impedance loading and matching, Selection of instruments.

Transducer Elements: Introduction of transducer and its classification, Construction, Operating principle and characteristics of resistive, inductive and capacitive transducer, Strain gauge, Light dependent transducer, LVDT, Piezoelectric transducer, Hall effect transducer, Thermistor, Thermocouple, RTD, and Proximity transducer, Microphone, and Camera.

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.

Electrical Measuring Instruments: Classification of measuring instruments, Ammeter, Voltmeter, Wattmeter, AVO meter, Energy meter, Clamp-on ammeter, Speed, Frequency and Phase difference measurements, Flux meter, Illumination measurement.

Electronic Measuring Instruments: Microphone, Camera, Q-meter, CRO and Microwave network analyzer. Wireless sensor and Instrument interfaces with MCUs: Arduino, STM32 and ARM processors, Sensor networks and wireless power

EEE 2212 Measurements and Instrumentation Sessional

Contact hours/week: 3

Credits: 3/2

Sessional based on the theory of course **EEE 2211**.

EEE 2213 VLSI Circuits and Design I

Contact hours/week: 3

Credits: 3

IC Technology and Basic Electrical Properties of MOS and BiCMOS: Moore's law, IC(s) and Scale integration, Glue logic, Evolution of VLSI, VLSI design flow, Basic MOSFET structures, Switch level modelling of PMOS and NMOS, Compound gates using CMOS, Transmission logic, Tristates, CMOS memory elements, NMOS inverter, Pull-Up to Pull-Down ratio of NMOS inverter, BiCMOS inverters, Latch up in CMOS circuits.

Fabrication and Design Processes of CMOS: CMOS fabrication, Twin-Tub fabrication process of CMOS, Lambda and Micron based design rules and layout, Basics of stick diagrams, Stick diagram rules, Design of complementary gates using stick diagrams.

Circuit Concepts and Scaling of MOS Circuits: Sheet resistance, Inverter resistance calculation, Area capacitance Calculation of MOS structures, Silicides, Scaling models and scaling factors, Limits of miniaturization.

Sub-System Design Processes, Layout and Computational Elements: Problems in large VLSI systems, Basic bus architectures, 4-bit shifter design, 4x4 barrel shifter, Regularity, Design of an ALU sub-system, Adder, Serial parallel multipliers, System timing considerations, Dynamic register element, 4-bit dynamic shift registers, Three transistors and one transistor memory cells, Dynamic and static flip-flops.

Practical Aspects of Design Tools and Testability of CMOS Design: Transition delay calculations of inverters, CIF code and geometric CIF primitives, CAD tools, Design rule checkers (DRC), Layout versus schematic (LVS), Rule of ten in VLSI systems test costs, Sensitized path-based testing, SA0 and SA1 faults in combinational logic testing.

Ultra-Fast VLSI Circuits and Systems: Introduction to GaAs technology, Superior electron mobility of GaAs technology, GaAs devices, FinFET and FDSOI technology.

Introduction and Application of VHDL: VHDL background and basic concepts, Structural specifications of hardware design organization and parameterization, VHDL design of finite state machines (FSM).

FPGA: Internal architecture, Programming languages, FPGA programming using a standard language, and applications.

EEE 2214 VLSI Circuits and Design I Sessional

Contact hours/week: 3

Credits: 3/2

Sessional based on the theory of course **EEE 2213**.

EEE 3100 Electronics Shop Practice

Contact hours/week: 3

Credits: 3/2

Aspects of Electronic Design: Component selection, Tolerances, Passive component characteristics, Analogue interface to digital circuits, Noise analysis and modeling, EMC, Grounding strategies and signal integrity, Heat conduction, and Dissipation.

Advanced Components and Sensors: Introduction to microcontroller modules e.g. Arduino, Different types of sensors interfacing (IR, PIR, ultrasonic sensor, sonar sensor, humidity sensor etc.), Robotics and automation, Introduction to IoT and its application, ARM processor e.g. STM 32, and different IoT modules, ESP 32, ADC and DAC modules etc.

PCB Design: Construction and manufacturing of printed circuit boards (PCB), CAD tools, Schematics, Simulation, Layout, Soldering, Testing and troubleshooting, Enclosures and mechanical construction.

Project: Students are required to design and build an electrical & electronic engineering project either individually or in a small group. This process will

include producing specifications, detailed design, prototype production and testing. The Design will be presented orally and documented in formal technical reports considering scheduling, marketing, and business plans.

EEE 3105 Control System Engineering

Contact hours/week: 3

Credits: 3

Introductory Concepts: Control goals, Classification of dynamic systems, Basic components of a control system, Open-loop and closed-loop system, Effects of feedback on overall gain, Stability and external disturbance or noise.

System Modeling: Transfer function, Signal flow graph, State-space, Transfer function to state variable and state variable to transfer function, Mathematical modeling of mechanical, electrical and electro-mechanical systems.

Time Domain Analysis: Transient and steady-state responses of first, second and multi-order dynamic systems, Steady state errors, Control of transient response, Basic control actions and their effects on transient and steady state responses.

Stability: Basics of stability, Classification, Routh-Hurwitz criterion, Root-locus.

Frequency Domain Analysis: Introduction of frequency response, Bode diagram, Polar plot, Nyquist Plot, and Nichols chart.

Design of Controller: Introduction of controller, Controllability, Observability, PID controller design, PID tuning, Lead-lag compensator, Pole placement technique, and Introduction to non-linear control system.

EEE 3106 Control System Engineering Sessional

Contact hours/week: 3/2

Credits: 3/4

Sessional based on the theory of course **EEE 3105**.

EEE 3107 Electrical Machines II

Contact hours/week: 3

Credits: 3

Three Phase Induction Motor: Operation, Types - Wound rotor, Squirrel case, Double case, Rotating magnetic field, Equivalent circuit, Phasor diagrams, 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, Braking, Cogging, variable frequency drives (VFD), Speed control, Derating, Different starter circuits, Linear induction motor, Induction generator, and Study of name plate ratings.

Single Phase Induction Motor: Theory of operation, Equivalent circuit, and starting techniques, No load test and blocked rotor tests.

Synchronous Generator: Windings, Excitation systems, Equivalent circuit, Phasor diagrams at different power factor loads, Effect of load changes with constant power factor and the respective phasor diagrams, Effect of field excitation changes and the respective phasor diagrams, Factors affecting voltage regulation, Synchronous impedance, Synchronous impedance methods of predicting voltage regulation and its limitations, and Synchronous generator ratings, Parallel operation: Necessary conditions, Synchronizing, Circulating current, Vector diagram, Frequency-power and voltage-reactive power characteristics of a synchronous generator, Frequency-versus power diagram (or house diagram) for a synchronous generator in parallel with an infinite bus, Effect of increasing the governor's set points on the house diagram and the phasor diagram, Operation of generators in parallel with other generators of the same size and the respective house diagrams, Shifting power sharing without affecting system frequency, Shifting system frequency without affecting power sharing, Shifting reactive power sharing without affecting terminal voltage, and Shifting terminal voltage without affecting reactive power sharing.

Synchronous Motor: Operation, Starting methods, Effect of load changes and the respective phasor diagrams, Effect of field current changes and the respective phasor diagrams, V-curves, Torque-speed characteristics curves, and study of name plate ratings.

EEE 3108 Electrical Machines II Sessional

Contact hours/week: 3

Credits: 3/2

Sessional based on the theory of course **EEE 3107**.

EEE 3109 Computational Methods in Engineering

Contact hours/week: 3

Credits: 3

Introduction and Development: Numerical method, Mathematical modeling and engineering Problem solving, Difficulties of numerical modeling, Basic concepts of errors in numerical computation: Approximation and round-off errors, Truncation errors and the Taylor series, Error propagation.

Roots of Non-linear Algebraic and Transcendental Equations: Bracketing method- Bisection method and false-position method; Open method- Fixed point iteration, the Newton-Raphson method, Secant method, Brent's method, Finding multiple roots, Systems of non-linear equations. Roots of polynomials: Muller's method and Baristow's Method.

Numerical Solution of Systems of Linear Algebraic Equations: Matrix theory, Vectorization, Gauss elimination method, Jacobi methods, LU decomposition and matrix inversion and Gauss Seidel method, Ill conditioning, Pivoting, Error analysis.

Interpolation, Approximation and Curve fitting: Least Square Regression, Polynomial, Spline interpolation, Double interpolation.

Numerical Integration and Differentiation: Newton methods, Trapezoidal method, Simpson's methods, Romberg integration, Double integration, Boole's method.

Numerical Solution of Ordinary Differential Equations: Euler's method and Runge-Kutta methods, Eigen value problems, System of ordinary differential equations.

Numerical Solution of Partial Differential Equations: Finite difference (FD) methods, Numerical stability, Implicit FD method.

Introduction to numerical optimization, Clustering and pattern recognition. Application of the numerical techniques in solving Electrical and Electronic Engineering problems.

EEE 3110 Computational Methods in Engineering Sessional

Contact hours/week: 3

Credits: 3/2

Sessional based on the theory of course **EEE 3109**.

EEE 3111 Power Systems I

Contact hours/week: 3

Credits: 3

Overview: Power generation, Transmission, and Distribution, Single line diagram of power systems.

Electrical Design of Overhead Transmission Lines: Types of conductors, Resistance, Definition of inductance, Inductance due to internal Flux, Inductance, and Capacitance Calculation, Double Circuit transmission lines, Bundled conductor lines, Charging current, Reactive power of line Parameters, Image conductors, Effect of earth on the line capacitance, Interference between power and communication lines.

Characteristics and Performance of Overhead Transmission Lines: Representation of lines, The short and medium-length transmission line, Phasors diagrams, The long transmission line, Equivalent circuits, Characteristic impedance, Surge impedance, Experimental determination of ABCD constants, Power circle diagram, Transmission efficiency and voltage regulation, Ferranti effect, Transmission line transients, Travelling waves, reflections,

Reactive Compensation of Transmission Lines: Methods of voltage control, Active and reactive power flow control in transmission lines.

Mechanical Design and Characteristics of Overhead Transmission Lines: Types of insulators and their coordination, Electric stress string efficiency, Insulator testing, Corona formation, Calculation of the potential gradient, Disruptive, and visual critical voltage, Corona power loss, Factors affecting corona loss, Sag and tensions, Effect of temperature change,

Catenary and parabolic methods, Effect of ice and wind, Effect of sag and tension on line design.

Power Cables: Construction of cable, Classification of cables, Insulation resistance, Dielectric stress, Capacitance of the cables, Charging current, KVAR due to capacitive current, Measurement of capacitance of a cable, Dielectric losses and heating, Skin effect, Proximity effect, Thermal breakdown, Testing of insulated cables, Kelvin's law, Economic conductor section, Limitations.

Power Distribution: Calculation of voltage drop and power loss in different DC and AC distribution network configurations.

EHV Transmission and HVDC Transmission Systems: Necessity of EHV transmission system, Types of DC links, Advantages of HVDC transmission systems, Power system harmonics, HVDC systems in Bangladesh.

EEE 3117 Communication Engineering I

Contact hours/week: 3

Credits: 3

Overview of Communication Systems: Basic principles, Fundamental elements, Message sources, Input-output transducers, Transmission policies, Analog and digital communication systems, their advantages and disadvantages, Introduction to communication networks, Communication traffics, Telephone, Satellite communication, RADAR communication, Fiber optic communication, Cellular communication, Radio and TV broadcasting, Radio switching systems, Cognitive radio networks etc.

Transmitter: Elements of transmitter and their functions, Transmission technologies, Concept of wireless transmission with antennas, Transmit diversity schemes, Channel state information at the transmitter, transmission delay. **Digitization:** Sampling and its classification, Sampling theorem, Nyquist criterion, Aliasing effect and its elimination, Quantizing, Quantization noise, Non-uniform quantization, Signal to quantization error ratio, Encoding, Line coding formats, Sample and hold circuit, Quantizer and encoder circuits, **Modulation:** Modulation and its principle, Importance of modulation, Definition, Graphical representation, Generation, Modulated signal's expression, Frequency spectrum and bandwidth requirements of AM, FM and PM, Design and fabrication of AM, FM and PM transmitter circuits.

Transmission Media: Types of media and their properties, Principle of information transmission through wire, Coaxial cable, Waveguide, Optical fiber, Radio link etc., Channel and its classification, PDF, CDF and MGF of channel gain, Modeling of fading channels, Expressions of received signals, Propagation delay, Bandwidth, Channel capacity and its classification, Outage probability, Bit error rate, Symbol error rate and their calculations, Effects of noise, Fading, Interference and correlation on the transmission media, *Noise:* Sources of noise, Characteristics of various types of noise,

Signal-to-noise ratio, Noise figure, Fading: Types of fading, Measures of fading channels, Interference: Types of interference and their mitigation techniques, Correlation: Types of correlation and their mitigation technologies, Digital link, Design of digital link.

Receiver: Receivers, Elements of receiver and their functions, Superheterodyne receiver, Design and fabrication of matched filter circuit and analog, Digital and correlator receiver circuits, Receiving antennas and channel state information at the receiver, Demodulation and Decoding: Principle of demodulation and decoding, Importance of demodulation, Demodulation and decoding of AM, FM and PM modulated signals, Design and fabrication of AM, FM and PM receiver circuits.

EEE 3118 Communication Engineering I Sessional

Contact hours/week: 3/2

Credits: 3/4

Sessional based on the theory of course **EEE 3117**.

EEE 3200 Technical Seminar

Contact hours/week: 3/2

Credits: 3/4

Students will work in groups or individually to prepare review articles on the corresponding topic of their thesis/project and will present before audience.

EEE 3202 Capstone Project Design I

Contact hours/week: 3/2

Credits: 3/4

Students will attend this course throughout the 3rd year even semester and submit the project at the end of 3rd year even semester. The theme of project should reflect the knowledge gained from 1st year odd semester to 3rd year odd semester.

EEE 3203 Power Electronics

Contact hours/week: 3

Credits: 3

Power Semiconductor Switch: Control characteristics of diode, BJT, MOSFET, SCR, IGBT, GTO, TRIAC and DIAC; Firing circuit; Protection circuit.

Controlled and Uncontrolled Rectifiers: Half-wave, Full-wave and three-phase rectifiers with R, RL and motor loads; Performance parameters; Freewheeling diode; Transient analysis of rectifier circuit with RL, Motor loads and freewheeling diode; Continuous and discontinuous mode of operation of the rectifier; Effect of source impedance on performance of the rectifier; Method of forced commutation; PWM rectifier; Semi converter;

Full converter; Dual converter; Multi-pulse rectifier: 6-pulse star and 12-Pulse bridge rectifiers; Harmonic analysis of the rectifier circuit.

AC Voltage Controller: Principle of phase angle control and on-off control; Unidirectional and bidirectional single-phase AC voltage controller with R, RL and motor loads; Three-phase star connected and delta connected AC voltage controllers; Harmonic analysis of the AC voltage controller circuit; Diac-Triac based fan regulator.

Cycloconverter: Single-phase to single-phase cycloconverter; Single-phase to three-phase cycloconverter; Three-phase to three-phase cycloconverter; Harmonic analysis of the cycloconverter circuit.

DC-DC Converter: Limitation of linear voltage regulator; Principle of step-up and step-down operation with R, RL and motor loads; Performance parameters; Switching-mode regulators: Buck, Boost, Buck-Boost and Cuk regulators.

Inverter: Performance parameters; Single-phase half-bridge and full-bridge inverters with R, RL and motor loads; Three-phase inverter with 120-degree and 180-degree conduction mode; Multilevel inverters, Harmonic analysis of the inverter circuit, Selective harmonic elimination method, Pulse width modulation: Bipolar switching and unipolar switching

Harmonic: Effect of harmonic on power system; IEEE-519 standard; Harmonic mitigation technique: Tuned filter, Damped filter, Active filter, Hybrid filter, Active injection method, Passive injection method and SPWM technique.

Static Switch: Single-phase and three-phase AC switches; DC switch; Transformer connection changer; Switch for bus transfer; Switch for Y- Δ starter of the induction motor; Switch for DC motor.

Power Supply: Uninterruptible power supply (UPS); Switched-mode power supply; Resonant power supply; Bidirectional power supply. Various applications of power converters.

EEE 3204 Power Electronics Sessional

Contact hours/week: 3/2

Credits: 3/4

Sessional based on the theory of course **EEE 3203**.

EEE 3207 Digital Signal Processing

Contact hours/week: 3

Credits: 3

Fundamentals of Digital Signal Processing: Signals, Systems, Signal processing: Definition, Classification and practical example; The concept of frequency in continuous time and discrete time signals; Matlab application in DSP.

Analysis of Discrete Time Signals and Systems: Analysis of discrete time signals: Auto-correlation, Cross-correlation, Linear Convolution and Circular Convolution of discrete time signals; Analysis of discrete time

systems: Impulse response, Finite impulse response (FIR) and infinite impulse response (IIR); Analysis of discrete time linear time invariant systems: Modeling of systems by difference equations.

Z-transform: Z-transform: Definition, Different process, Region of convergence (ROC); Inverse z-transform: Definition, Different process; Properties and application of z-transform and its inverse.

Discrete Fourier Transform (DFT): Discrete Fourier Series (DFS), Properties of DFS, Discrete Fourier Transformation (DFT), Inverse DFT, Properties and application of DFT.

Fast Fourier Transform (FFT): Twiddle Factor: Definition, Properties and application; FFT algorithms and their applications, IFFT algorithms and their applications, Butterfly and Signal Flow Graph (SFG).

Digital Filter Design: Digital filters: Definition, Objectives, Why digital filters, FIR filters, IIR filters, Filter equations, Choosing between FIR and IIR filters; Digital filter design steps: Specification analysis, Coefficient calculation, Realization structures, Finite word length effects, Implementation; FIR filter design: specifications, Design using window, optimal and frequency sampling methods; IIR filter design: Specifications, design using impulse invariant, Bi-linear Z transformation, Least-square methods; Introduction to adaptive filters.

Multirate DSP: Fundamentals of multirate digital signal processing. Up sampling, Down sampling, Interpolation, Decimation. Fractional Sampling. Polyphase Decomposition. Multi-stage Interpolation and Decimation Systems.

DSP Architectures and Applications: Different DSP architectures: All generations; DSP applications: RADAR, Speech processing, Fetal monitoring, ECG.

EEE 3208 Digital Signal Processing Sessional

Contact hours/week: 3/2

Credits: 3/4

Sessional based on the theory of course **EEE 3207**.

EEE 3211 Power Systems II

Contact hours/week: 3

Credits: 3

Introduction: Structure of power systems; Growth of power systems–overview, Interconnected system and their advantages.

Network Representation: Single line and reactance diagram of power system, Per unit representation.

Power Flow Analysis: Review of nodal analysis and construction of the bus admittance matrix; Network reduction and restoration technique; Necessity of power flow analysis, Difficulties and their solutions of power flow problems; Type of buses, Equations of power injections; Introduction to Gauss-Seidel, Newton-Raphson (NR), Decoupled and fast decoupled NR

methods; Solve power flow problems using these techniques; Power flow diagram, Contingency analysis, DC power flow study.

Symmetrical and Unsymmetrical Faults: Transients in RL series circuits, Short-circuit currents and the reactances of synchronous machine; Construction of the bus impedance matrix; Symmetrical fault analysis; Theory of symmetrical components, Sequence impedances and sequence networks, Positive-, Negative- and zero-sequence networks of generators, Transformers and transmission lines; Unsymmetrical fault calculation.

Power System Stability: Introduction to power system dynamics, Classification, Dynamic effects, Definitions; Power system stability problems/types, Swing equation, Solution of swing equation, Types of rotor angle stability; Power angle equation and power angle curve, Coherent machines, Synchronizing power coefficients; Equal area criterion, Critical clearing time and angle; Multimachine stability studies, Methods of improving stability.

Control of voltage, Active power and reactive power, Introduction to load frequency control (LFC), Automatic voltage regulator (AVR) and automatic generation control (AGC).

EEE 3212 Power Systems II Sessional

Contact hours/week: 3

Credits: 3/2

Sessional based on the theory of course **EEE 3211**.

EEE 3217 Communication Engineering II

Contact hours/week: 3

Credits: 3

Technologies at the Transmitting Side: Importance of multiplexing, Beamforming and coding techniques etc.

Modulation: Analog modulation; Principle of DSB-SC, DSB-WC, SSB-SC, SSB-SC and VSB, Analog pulse modulation, Definition, Graphical representation and generation of PAM, PWM and PPM, Principle of QAM, MQAM, Digital modulation, Definition, Graphical representation, Generation, Modulated signal's expression frequency spectrum and bandwidth requirements of ASK, FSK and PSK, Digital pulse modulation, PCM and DM, Principle of DPSK, BPSK, QPSK, MPSK, MSK, GMSK, CPFSK, Continuous and discontinuous FSK, DPCM, Adaptive DM, Multi-level modulation, Spaced vector modulations, Spaced control modulation, Multicarrier modulations, Hybrid modulation and selective harmonic elimination modulation, Multiplexing: Principle, Features, Receiver synchronization, Frame synchronization of TDM, FDM, CDM, SDM, WDM, SDH/SONET and PDH, Beamforming: Explicit and implicit beamforming, 5G beamforming, Analog, Digital, Switched and adaptive beamforming, Coding Techniques: Source coding, Huffman coding, Linear predictive coding, Block code, Linear block code, Hamming distance, Error

correcting code, Convolution code, Cyclic codes, Systematic and nonsystematic cyclic codes.

Technologies in the Transmission Media: Working principle of voltage, Current and power amplifiers, Audio, Video, Radio frequency (RF) and intermediate frequency (IF) amplifiers, Working principle of amplify-and-forward (AF) relay, Decode-and-forward (DF) relay and regenerative repeater.

Technologies at the Receiving Side: Importance of de-multiplexing, Multiple-accessing diversity combining, Decoding and equalization techniques, Demodulation: Demodulation, Detection and noise performance of PAM, PWM, PPM, ASK, FSK, PSK, PCM and DM, De-multiplexing: De-multiplexing of TDM, FDM, CDM, SDM, WDM, SDH/SONET and PDH, Multiple-accesses techniques: Principle and features of TDMA, FDMA, CDMA and SDMA, Random access techniques; Aloha, Slotted Aloha, Diversity combining techniques: Principle, Block diagram and maximum signal-to-noise ratio at the combiner output of Selection combining (SC), Maximal ratio combining (MRC), Equal gain combining (EGC) and switched-selection combining (SSC), Equalization: Principle of linear and non-linear equalizations.

EEE 3218 Communication Engineering II Sessional

Contact hours/week: 3/2

Credits: 3/4

Sessional based on the theory of course **EEE 3217**.

Hum 3211 Financial Account and Economic Analysis

Contact hours/week: 3

Credits: 3

Accountancy: Basic accounting principles, Transaction, Journal, Ledger and Accounts, Cash book, Bank Reconciliation statement. Preparation of Financial Statement, Cost Accounts and its objects, Cost classification, Elements of costs, Preparation of cost sheet, Overhead allocation, Use of Relevant costs in Decision-Making, Standard costing, Material cost variance, Break even analysis.

Economics: Definition of Economics, Economics and Engineering.

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

Macro-Economics: Savings, Investment, Employment, National income analysis. Inflation. Monetary policy, Fiscal policy and trade policy with reference to Bangladesh. Economics of development and planning.

The New Business Lifecycle: Selecting and testing a moneymaking idea, Preparing a business plan, Raising finance, Developing the brand, Delivery channels and customer relationships, Defining and testing critical business model uncertainties, Measuring progress.

Aspects of New Business Operation: Corporate form and structure, Founder dilemmas - team, Equity, Remuneration etc, Registering a company, Setting up an office, and exploiting new e-commerce tools and techniques (Doing business electronically, Company web sites, Online business software and services).

EEE 4002 Capstone Project Design II

Contact hours/week: 2

Credits: 3/4

Students will attend this course throughout the 4th year odd and even semester and submit the project at the end of 4th year even semester. The theme of project should reflect the knowledge gained from 1st year odd semester to 4th year even semester.

EEE 4100 Electrical Services Design

Contact hours/week: 3

Credits: 3/2

Electrical Wiring: Familiarization with CAD tools for building services design, Introduction to building regulations, Codes and standards: BNBC, NFPA etc., Terminology and definitions: Fuses, Circuit breakers, Distribution boxes, Cables, Bus-bars and conduits, Familiarization with symbols and legends used for electrical services design, Classification of wiring, Design for illumination and lighting: lux, lumen, Choice of luminaries for various applications- domestic building Office building and industry, Wattage rating of common electrical equipment, Designing electrical distribution system for low and high rise domestic, Office and academic buildings, For multipurpose buildings, Size selection of conductors and breakers, Bus-bar trunking (BBT) system for various applications.

Substation Design: Single line diagram (SLD) of a typical 11kV/0.4kV, 500kVA sub-station and a 200kVA pole-mounted transformer, Earthing requirements, Various earthing methods, Earthing and lightning protection system design.

Transmission Line Design: Line route selection and survey, Tower geometry and tower families optimization, Optimized conductor selection, Grounding and lightning stroke protection, Detailed support structure and tower design, Environmental impact mitigation.

Electrical Testing Design: Transformer, Motor, Generator, Earth resistance, Bulb, Vetting.

EEE 4109 Microprocessors and Embedded Systems

Contact hours/week: 3

Credits: 3

Introduction to Microcomputer: Basic components of a microcomputer system, Functional blocks of microprocessor, Microprocessor buses, Evolution of microprocessors.

Microprocessor Architecture: Features, Architecture, Microprocessor operation modes, Register layout, Memory organization, Timing diagrams of read and write cycles, Memory banks for 8086 and Arm Cortex microprocessors.

Assembly Language Programming: Assembly language programming for 8086 and Arm Cortex M /RISC-V based embedded microprocessors, Introduction to CISC and RISC processors.

Hardware Interfacing: Programmable peripheral interface, Programmable interrupt controller, Programmable timer (LED, 7 segment, dot matrix and LCD), Simple Arm/RISC-V based processor design with Verilog HDL. Introduction to embedded systems design, Software concurrency and realtime operating systems.

PLC: Internal architecture, Components and I/O modules, Hardware connection diagram, PLC programming languages, PLC programming using ladder diagram, and Applications.

Microcontroller: GPIO pins, Timer (normal mode, CTC mode, fast PWM mode, Phase correct PWM mode, Phase and frequency correct PWM mode, input capture mode, prescaler), Counter (up, down, up-down counters), USART, I2C, ADC, DAC, Interrupt, Advanced microcontroller (such as ATmega328P, STM32, etc).

Embedded systems for internet of things (IoT)

EEE 4110 Microprocessors and Embedded Systems Sessional

Contact hours/week: 3

Credits: 3/2

Sessional based on the theory of course **EEE 4109**.

EEE 4111 Power Plant Engineering and Economy

Contact hours/week: 3

Credits: 3

Introduction: Importance and generation of electrical energy; Sources of energy; Comparison of energy sources.

Power Generating Stations: Steam or thermal, Hydro-Electric, Diesel, gas, Combined cycle, and Nuclear power stations; Thermodynamic cycles: Rankine and Brayton Cycles; Schematic arrangement and choice of site for generating stations; Nuclear power reactors: WWER, PWR, BWR, PHWR,

AGR, etc.; Reactor construction and control; Nuclear hazards; comparison of various power plants; Environmental issues and mitigation techniques.

Load Curves and Factors: Variable load problems; Plotting and analysis of load Curves; Chronological load curve and load duration curve; Energy load curve and its use; Load factor, Capacity factor, Demand factor, Utilization factor, Diversity factor, etc. and their impact on the cost analysis of power generation and utilization.

Load Forecasting: Types of load forecasting based on timespan and their use; Introduction to modern load forecasting techniques.

Load Shearing: Base load and peak load plants; Use of chronological load curves to distribute load among units; Transmission line loss; Determination of loss co-efficient; Economic load dispatch without and with considering transmission line loss.

Power Plant Economics: Economics of power generation; Cost of electrical energy; Methods of determining depreciation; Input-output curve, Heat rate curve, Incremental rate curve; Use of incremental rate curve for optimum load scheduling; Economic conductor selection, Kelvin's law and its limitations; Economic choice of transmission voltage; Graphical method for location of distribution systems; Tariff and tariff design.

Bus System and Reactors: Bus System; Importance of power control; Current limiting reactors; Different types of bus system layout; Forces on bus section in case of short circuit.

Substations: Different types of substations; Substation design and Substation equipment layout.

Net metering, SCADA, Micro-grid, Smart grid.

IPE 4111 Engineering Management, Laws and Safety

Contact hours/week: 3

Credits: 3

Business and Industrial law: Law of contract, Elements of valid contract. Consideration, Parties competent to contract. 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.

Marketing Management: Understanding marketing management, Developing marketing strategies, Conducting marketing research, Analyzing consumer and business market, Identifying market segments and targets, Dealing with competition.

Project Management: Project identification and selection, Planning, Appraisal, Project implementation, Project organization, Budgeting, Scheduling using bar diagram, CPM, PERT, Resource allocation, Information system and project control, Project termination, Matrix organization, Project manager, Contract negotiation and conflict resolution, Evaluation of an investment project, Project failure and risk control.

Operations 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.

EEE 4211 Power System Protection and Switchgear

Contact hours/week: 3

Credits: 3

Circuit Breaking Fundamentals: Philosophy of switchgear and protection, Principle of arc extinction in DC and AC circuit breakers. Recovery voltage, Rate of rise of recovery voltage, and other transient phenomena, Disconnection of unloaded transformer and transmission line, Speed of circuit breaker.

Electrical Switchgear: Operating mechanisms, Construction and operation oil circuit breaker, SF₆ circuit breaker, ABCB, ACB, VCB, and HVDC circuit Breakers, High Rupturing Capacity (HRC) Fuse, Drop Out Fuse (DOF), Load Break Switches, Contactors, MCB, MMCB, Protective CT, and PT and CCVT (Capacitor Coupled Voltage Transformer), MOCT (Magneto Optical Current Transducer), Selection of circuit breaker.

Protective Relays: Principal and general equations of Electromechanical Relays, Overcurrent, Balanced Current, Overvoltage, Directional, Positive Sequence, Negative Sequence, and Differential relays and their applications, Principles of simple impedance relay, Reactance relay, MHO relay. Impact of Power swing on performance of distance relays.

Static and Numerical Relays: Introduction to solid-state device in the construction of static relays, different types of static relays, Numerical relay.

Overvoltage Protection: Switching surges, traveling wave in transmission line, and specifications of lightning stroke, Shielding wires, Surge absorber, and different types of lightning arrester (Horn Gap, Thyrite-Type, Valve-Type, and Metal Oxide Surge Arresters)

Protection Applications: Protection of generators, Transformers, Transmission lines, HVDC systems, Bus bars, and feeders, Wide area power systems protection and security, Design of a residential building's protection system.

EEE 4212 Power System Protection and Switchgear Sessional

Contact hours/week: 3/2

Credits: 3/4

Sessional based on the theory of course **EEE 4211**.

EEE 4217**Microwave Engineering**

Contact hours/week: 3

Credits: 3

Introduction to Microwaves: History and applications, Microwave transmission modes.

Microwave Transmission Lines: Transmission line theory, Telegrapher's equations. Analysis of lossless and lossy transmission lines. VSWR, Reflection coefficient, The smith chart, Quarter-wave transformers, Impedance matching and tuning, Microstripline and stripline.

Microwave Network Analysis: Lossless reciprocal and non-reciprocal networks, ABCD parameters and S-parameters.

Microwave Generation: Multicavity klystron amplifier, Magnetron, Tunnel diodes, and Gunn-effect diodes, Microwave resonators: Waveguide cavity resonators, Microstrip resonators.

Microwave Radiation and Antennas: Fundamentals, Friis transmission equation, Mathematical modeling and analysis of antenna's parameters, Dipole, Monopole, Arrays, Microstrip, Horn, Helical, Yagi-Uda, Log-periodic and reflector antennas.

Microwave Components: Microwave filters, Attenuator, Waveguide tees, Directional couplers, Circulators and isolators.

Microwave Measurements: Microwave systems, Link budget, RFID, RF MEMS, Effect of microwaves on human body, Microwave imaging.

EEE 4218**Microwave Engineering Sessional**

Contact hours/week: 3/2

Credits: 3/4

Sessional based on the theory of course **EEE 4217**.

Hum 4212 Engineering Ethics, Environmental Sustainability and Innovation

Contact hours/week: 3

Credits: 3/2

Introduction to Ethics, Sustainability and Corporate Social Responsibility: Environmental ethics in general and three different kinds of environmental ethics in specific, Sustainable development goals and GOAL 17 (Partnership to achieve the goals).

Anthropogenic Impact on the Environment: Climate change, Pollution, Waste, Overpopulation, Environmental degradation, Resource depletion.

The Grand Challenges: Water, Food, Medicine, Energy (electricity and heat), Environmental management of wicked problems.

Conflicting Effects (Examples Might Include): Fuel versus food, Hydro-power versus damage to farmland and fishing, Convenience versus sustainability, Rapid urbanization versus sustainable development.

Sustainable Design and Development: An overview of social, Environmental and economic aspects of the built environment. Site

considerations, Infrastructure, Green buildings, Marketing, Financing, Community. (Local field trips possible.).

Design for Energy Efficiency: An overview of energy efficiency in residential and small commercial settings, Energy, Building shell, Air leakage, Insulation, HVAC, Lighting, Appliances, Water heating, Indoor air quality. (Local field trips possible.).

Energy Engineering: An introduction to the basic principles governing energy use, Energy sources, and the impact of energy production on the environment, Examines the amount of energy used by society, Fossil fuels and alternative energy sources, and methods of energy production.

Decision-support Tools: Tools and methods such as cost-benefit analysis, Risk assessment, Technology assessment often provide support to decision-maker when it making decisions about how to best management the environment and environmental resources, These decision-support tools have different ethical foundations and different set of values embedded in them, which are important to have in mind.

Innovation: Conceptualize, Design and develop a technology oriented new product after identifying the consumer needs, Prototyping the product may be included, Idea about intellectual property rights.

Elective Courses Offered by the Department of EEE

Power Track

EEE 4141 Power System Stability and Control

Contact hours/week: 3

Credits: 3

Overview of Power System Stability

Stability of Dynamic Systems: State-space representation, Stability of a dynamic system, Linearization, Analysis of stability.

Small Signal Stability Analysis of Power Systems: Introduction, Formal solution method, Small signal stability of classical model, The effect of field circuit dynamics, Excitation, Power system stabilizer, TCSC, SVC and damper windings on small signal stability of SMIB system, Small signal stability analysis of a multi-machine system.

Power System Stabilizer: Introduction, Control signals, Power system stabilizer, Structure – stabilizer based on shaft speed signal (Delta Omega) – Delta P-Omega stabilizer, Frequency based stabilizers, Digital stabilizer, Designing methods of stabilizer, Recent development and trends in PSS, System state matrix including PSS, Role of power system stabilizer in multi-machine small signal stability analysis.

Sub-Synchronous and Torsional Oscillations: Introduction to sub synchronous resonance (SSR), Methods of analysis of SSR, Mitigation

techniques of SSR, Computation of torsional natural frequencies, Effect of degree series compensation on network natural frequency.

Transient Stability Analysis of Power Systems: Response to a step change in mechanical power input, Numerical integration method: Euler method, R-K method (4th Order), Methods for improving transient stability, Salient pole synchronous machine model.

Transient Stability Enhancement: High-speed fault clearing, Reduction of transmission system reactance, Regulated shunt compensation, Dynamic braking, Reactor switching, Independent-pole operation of circuit breakers, Single-pole switching, Steam turbine fast-valving, Generator tripping, Controlled system separation and load shedding, High-speed excitation systems, Discontinuous excitation control, Control of HVDC transmission links.

Midterm and Long-Term Stability: Nature of the system response to severe upsets, Distinction between midterm and long-term stability, Power plant response during severe upsets

Reactive Power Control and Voltage Stability: Relation of reactive power with voltage, governing effect of reactive power on steady state operation of a power system, Sensitivity of voltage to the reactive power in power system, Reactive power requirement for controlling the line voltage, Characteristics of reactive power compensating devices, Voltage stability: Basic concept, Transmission system characteristics, Generator characteristics, Load characteristics, PV curve, QV curve and PQ curve, Voltage stability limit, Voltage stability indices, Voltage collapse and prevention of voltage collapse.

EEE 4142 Power System Stability and Control Sessional

Contact hours/week: 3/2

Credits: 3/4

Sessional based on the theory of course **EEE 4141**.

EEE 4143 High Voltage Engineering

Contact hours/week: 3

Credits: 3

Introduction: High voltage engineering- importance, Classification, and Scope. Classification of electric fields, Electrode configurations.

Breakdown Mechanisms of Materials: Electric breakdown in gases, Townsend's first, and second ionization coefficient, Townsend's criterion for spark formation, Streamer, Paschen's law, Penning effect, Corona discharges, Time lag, Power loss due to Corona, Electronegative gases, Breakdown in solid and liquid dielectrics. Applications of gases in high voltage systems.

Generation of Power Frequency High Voltage: Generation of high DC voltage- rectifier, Electrostatic generator, and Voltage multiplier. Generation of AC high voltage- cascaded transformer, and Resonant circuit.

Generation of High Frequency Voltage and Currents: Impulse wave shapes and standards, Single- and multistage impulse generators, Design consideration of impulse generators, Impulse current generator.

Measurement of High Voltage and Currents: Sphere Gap, Uniform field spark gap, Rod gap. Electrostatic voltmeter, Generating voltmeter, Peak voltmeter, Voltage dividers, Rogowski coil.

High Voltage Testing: Destructive and non-destructive testing, Testing of power cable, Power capacitor, Overhead line insulators, Power transformer, circuit breaker, and Insulating oil. Testing of other power apparatus. Measurement of insulating resistance, Loss tangent, and Partial discharge.

Overvoltage Phenomena and Insulation Coordination: Lightning and switching surges, Formation of lightning strokes, Surge absorber, Surge diverter, Lightning arrester, BIL, SIL, insulation co-ordination.

EEE 4144 High Voltage Engineering Sessional

Contact hours/week: 3/2

Credits: 3/4

Sessional based on the theory of course **EEE 4143**.

EEE 4145 Industrial Automation and Control

Contact hours/week: 3

Credits: 3

Introductory Concepts: Introduction to industrial automation and control, Architecture of industrial automation systems.

Transducer Elements: Introduction of transducer and its classification, Measurement of temperature, Light, Level, Pressure, Flow, and Position.

Process Control: Introduction to process control, PID control, Controller tuning, Implementation of PID controllers, Special control structures, Feed forward and ratio control, Predictive control, Control of systems with inverse response.

Programmable Logic Control Systems: Introduction to sequence or logic control and programmable logic controllers, Software environment and programming of PLCs, Formal modeling of sequence control specifications, PLC hardware environment.

CNC Machines and Actuators: Introduction to computer numerically controlled machines, Control valves, Hydraulic actuation systems, Principle and components, Directional control valves, Switches and gauges, Industrial hydraulic circuits, Robotic arms.

Electrical Machine Drives: Energy savings with variable speed drives, Step motors: principles, construction and drives, Electrical actuators, DC motor drives, Induction motor drives, BLDC motor drives.

EEE 4146 Industrial Automation and Control Sessional

Contact hours/week: 3/2

Credits: 3/4

Sessional based on the theory of course **EEE 4145**.

EEE 4147 Renewable Energy

Contact hours/week: 3

Credits: 3

Introduction: Definition and importance of renewable energy; Introduction to the types of renewable energy sources and their feasibility of use, Statistics of the worldwide use of renewable energy.

Solar Energy: Energy states in solids and photoelectric effect, Photogeneration in photovoltaic cell, Equivalent circuit of a solar cell, Mathematical model of a solar cell, Characteristic parameters of solar cell, I-V characteristics and maximum power point, Effect of temperature and irradiation on the characteristics of solar cell, Effect of parasitic resistance on I-V characteristics, maximum power point, and fill factor, PV module and array, Partial shadowing, Protection under partial shadowing condition, and I-V characteristics under partial shadowing, Maximum power point tracking (MPPT) algorithms; Concept of impedance matching using DC-DC boost converter and implementation of MPPT, PV to grid connection topologies, Solar tracking; Energy storage technologies for solar PV system.

Wind Energy: Introduction and statistics of global wind energy generation, Classification, structure, and rotational mechanism of wind turbine, Calculation of wind power, Power output from a practical wind turbine, Betz limit, Cut-in and cut-out speed, Pitch control and stall control, Generation and grid connection mechanism of IG, PMSG, and DFIG based wind turbines; Challenges to implement wind energy.

Microgrids: Definition, features, benefits, and challenges of microgrids, Challenges with conventional power grid and introduction to distributed generation (DG), Challenges with DG, Components of a microgrid, Modes of operation of a microgrid, A case study simulation model for a hybrid microgrid system containing wind turbine generators, PV array, Aqua-electrolyzer, Fuel cell, Diesel engine, Flywheel energy storage system, and Battery energy storage system, Energy management system for hybrid microgrid system containing renewable energy sources and energy storage system, Hierarchical control of AC and DC microgrids- primary, secondary, and tertiary control, Reference frame transformation- Clarke and Park transformation, Phase locked loop (PLL) and Grid synchronization of single phase and three phase DG inverters, Concept of supplying active and reactive power by an inverter, Types of power inverters in a microgrid- grid forming, Grid feeding and grid supporting inverters, Inner current and voltage control of DG inverter in stationary and synchronous reference frame; DG inverter power sharing using droop control principle in AC and

DC microgrids, Virtual impedance loop to decouple real and reactive power control.

Smart Grids: Definition and benefits of smart grid, Smart meter, Use of smart meter in reducing electricity bill and peak shaving of load curves.

Hybrid Electric Vehicle (HEV): Definition, Statistics of worldwide carbon emission by transportation sector, Classification and detailed structure of HEVs based on drivetrain configuration, Degree of hybridization, and Nature of energy sources, Plug in HEV, Types of battery technologies, Electric motors, and Power converters used in EV/HEV, Fuel cell EV/HEV, Hydraulic hybrid vehicle, Power control unit of EV/HEV, Hierarchy of control of HEVs.

EEE 4149 Special Machines and AC Drives

Contact hours/week: 3

Credits: 3

Special Machines: Universal Motor, Brushless DC (BLDC): Unipolar (One-phase on operation), Bipolar (Two-phase on operation, Three-phase on operation), Permanent magnet DC (PMDC) motor, Stepper motor with drives circuits, Reluctance and Hysteresis motors with drives circuits, Switched reluctance motor, Electro static motor, Repulsion motor, Servo motor, Core less DC motor, Permanent magnet synchronous motors.

Acylic Machines: Generators, Conduction pump and Induction pump.

Magneto Hydrodynamic Generators: Vector control, Linear motors and Traction.

AC Drives: PWM converter fed induction motor drives, Dynamic modeling of induction machines, Generalized model in arbitrary Reference frame, Stator reference frame model, Rotor reference frame model, Synchronously rotating reference frame model, Vector control, Vector controlled induction motor drive, Stator flux oriented vector control, Indirect rotor flux oriented vector control scheme, Flux weakening operation, Speed controller design, Direct torque control of induction motor.

Synchronous Motor Drives: Converter-fed synchronous motor drives. Permanent magnet synchronous motor drives - Vector control strategies.

EEE 4241 Internet of Things

Contact hours/week: 3

Credits: 3

Industry 4.0: Globalization and emerging issues, The fourth revolution, LEAN production systems, Smart and connected business perspective, Smart factories, Cyber physical systems and next generation sensors, Collaborative platform and product lifecycle management, Augmented reality and virtual reality, Artificial intelligence, Big data and advanced analysis, Cybersecurity in industry 4.0.

Basics of IIoT: Industrial processes, Industrial sensing and actuation, Industrial internet systems.

Architecture and Components of IIoT: Basis of IIoT, The difference between IoT and IIoT, Architecture of IIoT, IoT node, Challenges of IIoT. Fundamentals of control system, Introductions, Components, Closed loop and Open loop system. Introduction to sensors, Working principle of basic Sensors -Ultrasonic sensor, IR sensor, MQ2, Temperature and humidity sensors (DHT-11) Digital switch, Electro mechanical switches.

IIoT- Layers: IIoT sensing, IIoT processing, IIoT communication, IIoT networking.

Big Data Analytics and Software Defined Networks: IIoT analytics - Introduction, Machine learning and data science, R and Julia programming, Data management with hadoop, SDN in IIoT, Data center networks.

Security and Fog Computing: Cloud computing in IIoT, Security in IIoT.

IIoT Application Domains: Health monitoring, Food industry, Smart irrigation, Oil- chemical and pharmaceutical industry, IoT smart city, Robot surveillance, Applications of UAVs in industries.

EEE 4242 Internet of Things Sessional

Contact hours/week: 3/2

Credits: 3/4

Sessional based on the theory of course **EEE 4241**.

EEE 4243 High Voltage Transmission Systems

Contact hours/week: 3

Credits: 3

HVAC Transmission Systems: Fundamentals of AC power transmission, Transmission problems and needs, Overview of stability, The emergence of FACTS, FACTS controller and consideration, Active and reactive power control mechanism using FACTS controller, Static shunt compensation, SVC, STATCOM, Series compensation, GCSC, TSSC, TCSC, Switching converter type series compensator, SSSC, Subsynchronous oscillation damping, Static voltage and phase angle regulators, TCVR, TCPAR, Unified power flow controllers (UPFC), Interline power flow controllers (IPFC), Dynamic and transient stability, Enhancement using the compensation techniques, Basic converter and control schemes of different types of compensation techniques.

HVDC Transmission Systems: Evaluation of HVDC transmission, Comparison of HVDC and HVAC systems, Types of HVDC transmission systems, Components of HVDC transmission systems, Analysis of simple rectifier circuits, Required features of rectification circuits for HVDC transmission, Analysis of HVDC converters, Different modes of valve operation, Output voltage waveforms and DC voltage in rectification, Output voltage waveforms and DC in inverter operation, Valve voltages, Equivalent electrical circuits, Converter circuits, HVDC system control features, Control modes, Control schemes and control comparison,

Energization and de-energization of bridges, Starting and stopping of HVDC link, Converter mal-operations, Communication failure, Converter protection, DC reactor and damper circuits, Harmonic analysis, Filter design, Grounding and DC lines, Reactive power requirements, Component models for the analysis of AC-DC systems, Power flow analysis of AC-DC systems, Transient stability analysis, Dynamic stability analysis, Multi-terminal HVDC system, HVDC light, HVDC system in wind power generation.

EEE 4244 High Voltage Transmission Systems Sessional

Contact hours/week: 3/2

Credits: 3/4

Sessional based on the theory of course **EEE 4243**.

EEE 4245 Nuclear Power Engineering

Contact hours/week: 3

Credits: 3

Basic Concepts: Introduction to nuclear engineering, A short review of nuclear physics, Basic concepts in neutron reactions, The fission and fusion reaction, Non-nuclear components of nuclear power plants.

Nuclear Systems: Layout of nuclear power plants, Description and analysis of power plant systems and components, Basic considerations in nuclear plant design, Components of nuclear power cost, Economic comparison of nuclear and fossil fuel plants, Dual and multipurpose nuclear plants, Future trends in nuclear power cost.

Nuclear Power Plant Reactors: Principles of nuclear reactor and core design, Nuclear steam supply system (NSSS), Reactor pressure vessel and primary coolant pump, Pressurizer, Steam generator, Separator and dryer, Pressurized water reactor, Boiling water reactor, CANDU reactor, Gas cooled reactor, Liquid metal cooled reactor, Design of reactor shielding and reflector, Description of safety concept and safety parameters of reactors.

Power Generation and Grid Stability: Basics of nuclear power generation from NPPs, Effects of frequency and voltage changes, Advanced and next generation nuclear plants, Very high temperature reactors, Biological effects, Three mile island Case, Chernobyl case, Fukushima case. Fuel cycle, Pre-treatment of radioactive wastes and their disposal.

Applications: Medical applications, Nuclear weapon etc.

EEE 4247 Smart Grids

Contact hours/week: 3

Credits: 3

Introduction: Introduction to power system operations, Difference between Existing and smart grids, Interoperability and standards, Application of computational intelligence in smart grids.

Smart Grid: Two way communication, Distributed energy resources (Ders) - DG (Distributed generation) And ES (Energy storage), High power density batteries, EV (Electric vehicles) and PHEV (Plug-In hybrid electric vehicles), Smart sensors, Meters and Appliances at demand side.

Smart Grid Analysis: Optimal power flow in smart grids

Communications: Global information system (GIS), Google mapping tools, Multi-agent systems (MAS), Microgrids.

IEEE 802 Series Wireless Lans: Bluetooth, Zigbee, Wimax, Wired Lans-Ethernet, PSTN, PLC (Power Line Carrier), Cyber security.

Smart Meters and AMI (Advanced Metering Infrastructure): Construction; Standards for information exchange- Modbus, DNP3 and IEC61850, Interfacing with HAN, NAN, WAN. Power electronic Interfaces between Grid and DERs.

Demand Side Integration (DSI): DSM, Real time pricing, Ancillary markets, DR (Demand response) for load shaping, Frequency and voltage control, Energy efficiency, Microgrids, Self-healing and restoration.

EEE 4249 Power System Operation and Control

Contact hours/week: 3

Credits: 3

Energy Management System: Basic model of ems and application functions.

SCADA: Basic structure of scada, Phasor measurement unit, Intelligent electronic device, Hierarchical control of power system.

Power System Operation in Competitive Environment: Role of independent system operator (iso), Operational planning activities of iso, Operational planning activities of a genco, Unit commitment in deregulated environment, Competitive bidding.

Automatic Generation Control: Block diagram and transfer function model of LFC and AGC control loop in single area system, Analysis of frequency deviation and load sharing in single and multi-area LFC system using final value theorem, Role of secondary control for frequency regulation in AGC system. Tie line bias control in multi-area agc system, Stability analysis of LFC control loop using classical methods.

Reactive Power and Voltage Control: Block diagram and transfer function model of AVR control loop, Stability analysis of AVR control loop using classical methods.

Economic Operation of Power System: Distribution of load between units within a plant, Economic dispatch with and without considering transmission line loss, Analysis of transmission line loss using kron's method, Unit commitment and solving unit commitment problem using dynamic programming method.

Optimal Power Flow: Limitations of economic dispatch and introduction to optimal power flow (OPF), Mathematical formulation of OPF problem using Dommel and Tinney method, Introduction to gradient descent

algorithm for solving nonlinear equations, Solution algorithm of Dommel and Tinney method, Handling inequality constraints in OPF problem, Introduction to optimal reactive power flow.

State Estimation: Method of least square, Weighted least square error objective function and criterion for minimization, Calculation of least square estimate, Statistical analysis of error and estimates, Test for bad data, Power system state estimation, Formulation of linearized equations for calculating the weighted least-squares estimates of power system states, Structure and formation of state estimation Jacobian.

Power System Security: Security related constraints, Security related states, Contingency analysis techniques, Ranking of contingencies, Contingency analysis based on distribution factors: Line flow change due to generator outage and line outage, Contingency ranking based on ranking index, Contingency ranking based on fast decoupled load flow.

EEE 4251

Power System Reliability

Contact hours/week: 3

Credits: 3

Review of Probability Concepts.

Probability Distribution: Binomial, Poisson, and Normal.

Reliability Concepts: Failure rate, Outage, Mean time to failure, Series and parallel systems and redundancy. Markov process. Probabilistic generation and Load models.

Reliability Indices: Loss of load probability and Loss of energy probability. Frequency and Duration. Reliability evaluation techniques of single area system.

Interconnected System: Tie line and evaluation of reliability indices.

Electronics Track

EEE 4161

Digital Electronics II

Contact hours/week: 3

Credits: 3

TTL: TTL NAND Gate Operation, Current-sourcing and Current-sinking action, Totem pole output circuit, TTL NOR gate, Standard TTL characteristics, Supply voltage and temperature range, Voltage levels, Power dissipation, Propagation delay, Fan out, Introduction to improved TTL series, TTL loading and fan out, Other TTL Characteristics, Connecting TTL outputs together, Open collector output, Tri-state, TTL driving CMOS, Problem with TTL.

ECL: Basic ECL circuit, ECL OR/NOR gate, ECL characteristics, Fan out, Speed of operation.

CMOS Logic Families: Introduction to Enhancement type NMOS, PMOS and Depletion MOS. Comparison of NMOS and PMOS with respect to speed. Design of NOMS inverter with resistive load, with NMOS enhancement load and with NMOS depletion load. Edge time and speed calculation for NMOS inverter with depletion load. CMOS inverter: Circuit diagram, Operation, Transfer Characteristic and Noise margin. Design of basic CMOS gates (NAND gate and NOR gate) with specified parameters (rise time and fall time). Circuit implementation from logic equations. NMOS pass transistors and CMOS pass gate. Implementation of multiplexer by NMOS and CMOS pass gate. Buffer circuit. CMOS gates driving TTL gates and comparison of CMOS logics with TTL logics. Design of basic logic gates using CMOS and BiCMOS.

Interfacing Data Converters:

Digital to Analog Converters (D/A): The binary weighted resistor D/A converter. The R/2R ladder D/A converter. The inverted ladder D/A converter. Specification for D/A converters (Resolution, Linearity, Settling time and Accuracy).

Analog to Digital Converters (A/D): Flash converters, Successive approximation converter and Dual slope converter. A/D converter specifications (Analog input voltage, Input Impedance, Accuracy, Conversion time etc.). A comparison of converter types. Sample and hold circuit (S/H), Interconnecting the S/H circuit and the A/D converter.

EEE 4162 Digital Electronics II Sessional

Contact hours/week: 3/2

Credits: 3/4

Sessional based on the theory of course **EEE 4161**.

EEE 4163 VLSI Circuits and Design II

Contact hours/week: 3

Credits: 3

Scaling of MOS Transistor and Interconnect: RC delay modeling, Repeaters and cascaded drives. Advanced CMOS nanometer process flow and enhancement of CMOS process, Technology related CAD issues and manufacturing issues, Design margin and PVT corners.

Circuit Aharacterization: Delay estimation and transistor sizing for minimum delay, Crosstalk and noise analysis. High speed digital circuit design techniques, Circuit families.

Architecture for High-speed Design: Carry select, Carry skip, Carry look ahead and Tree adders. Modified Booth algorithm, Wallace tree multiplication.

Sequential Circuit Design: Sequencing methods, Maximum and minimum delay constrains, Clock skew. Design of latches and flip-flops, Clock Generation and synchronization, High-speed clock generation and

distribution. ASIC Cell based design, standard cell place and route design, Timing directed placement design, mixed signal design.

Interchange Formats: LEF, DEF, SDF, DSPF, SPEF, ALF PDEF, CIF and GDS2. Floor planning, Power distribution and I/O design.

Algorithm and Architecture for Digital Processors in Verilog, System Verilog and System-C: Building block for signal processors, Digital filters and Signal processors, Pipelined architecture.

Architecture for Arithmetic Processors: Addition, subtraction, multiplication and division. Complete design of a simple RISC processor.

Post-synthesis Design Validation: Timing verification, Fault simulation and testing, Design for test.

High Speed and Low Power Memory Circuit Design: Advanced topics in DRAM and SRAM.

EEE 4164 VLSI Circuits and Design II Sessional

Contact hours/week: 3/2

Credits: 3/4

Sessional based on the theory of course **EEE 4163**.

EEE 4165 Fabrication and Processing Technology

Contact hours/week: 3

Credits: 3

Monolithic Fabrication Processes and Structures: Substrate materials: Substrate properties and classification, Crystal growth and wafer preparation, epitaxial growth technique, Molecular beam epitaxy, Chemical vapor phase epitaxy, and Chemical vapor deposition (CVD).

Cleaning: Surface cleaning, Organic cleaning, and RCA cleaning and other standard cleaning

Doping and Deposition Technique: Diffusion and ion implantation. Growth and deposition of dielectric layers: Thermal oxidation, CVD, plasma CVD, sputtering, and silicon-nitride growth. Film Deposition: Evaporation, E-beam evaporation, Sol-gel, Spray-pyrolysis, Spin-coating, Hydrothermal, Anode-oxidation, Chemical bath deposition.

Etching: Wet chemical etching, Silicon and GaAs etching, Anisotropic etching, Selective etching, Dry physical etching, Ion beam etching, sputtering etching, and Reactive ion etching.

Diffusion: Mathematical model, Constant source diffusion, Limited source diffusion, Two-step diffusion, Sheet resistance, Diffusion systems: Boron, Phosphorous, Ion implementation.

Basic MOS Process: Basic Bipolar process, Photolithographic process, Pattern generation, Pattern transfer, and metallization, Steps of lithography. Nonoptical lithography. Mask: Mask generation and alignment, Photo mask fabrication. Baking: Soft and hard baking, Oxidation: Thermal oxidation, Oxide quality, Oxide thickness characterization.

Discrete Device Fabrication: Diode, Transistor, Resistor and Capacitor.

Integrated Circuit Fabrication: Isolation: p-n junction isolation, Mesa isolation and oxide isolation, BJT based microcircuits, p-channel and n-channel MOSFETs, complimentary MOSFETs and silicon on insulator devices. Interconnection, contacts, Testing, bonding and packaging.

EEE 4166 Fabrication and Processing Technology Sessional

Contact hours/week: 3/2

Credits: 3/4

Sessional based on the theory of course **EEE 4165**.

EEE 4167 Optoelectronics

Contact hours/week: 3

Credits: 3

Light and Conceptual Overview: Nature of light, Polarization, Principle of superposition, Interference, Coherence, Diffraction, Optical resonators, Refractive index, group and phase velocity, Introduction to quantum mechanics.

Modulation of Light: Elliptical polarization, Birefringence, Quarter wave plate, Optical activity, Electro-optic effect, Scanning and switching, Magneto-optic effect, Acousto-optic effect, Kerr effect, Faraday effect, Quantum dot and quantum wells, Nonlinear optics.

Optical Communication Systems: Introduction to optical fiber and optical waveguides, Light guiding mechanisms.

Light Sources and Display Devices: Luminescence, Photoluminescence, Cathodoluminescent, Electroluminescence, LED materials, construction and operation, Response time, Blackbody radiation, plasma displays, LCD, numerical display.

Lasers: Lasing mechanism, Emission and absorption, Einstein relation, Population inversion, Optical feedback, Laser losses, Line shape function, Laser modes, Classes of laser, Semiconductor lasers, homojunction and heterojunction diode laser, Fiber laser, VCSEL, Laser applications, Optical amplifiers, Fabry-Perot amplifier, Travelling-wave amplifier, Erbium-doped fiber amplifier, Distance measurements, Holography.

Photo Detectors: Principles of photodetection, Thermal detectors, Photo emissive detectors, Vacuum photodiodes, Photomultipliers, Noise in photomultipliers, Image intensifier, Photoconductive detectors, Semiconductor detectors, *pn* photodiode, PIN Photodiode, Avalanche Photodiode, Phototransistor, Detector arrays.

Application of Optoelectronic Devices: Basic physics and operation of solar cells, Optical modulators, Electro-absorption modulators, Electro-optic modulators, Kerr modulators, Acousto-optic modulators, Optoelectronic integrated devices.

EEE 4169**Analog Integrated Circuits**

Contact hours/week: 3

Credits: 3

IC Op-Amp Applications: Op-amp fundamentals (brief review of differential amplifier, Current mirror, active load, level shifter, output stage; AC and DC characteristics), Basic building blocks using op-amps. Inverting/non-inverting VCVS, Integrators, Differentiators, CCVS and VCCS, Instrumentation amplifiers.

Waveform Generator: Square wave generators, Crystal controlled oscillator ramp generator, Triangle generator, Sawtooth generator, Sine wave generator, Requirement for sinusoidal oscillations, Wien-Bridge and Twin-T oscillators.

Function Generators: Multi Op-amp function generators, IC function generators.

Digitally Controlled Frequency Synthesizer: PLL fundamentals, PLL Synthesizer, Totally digital synthesizer.

Active Filters: Introduction to filtering (frequency response, characteristics, and terminology, active versus passive filters), Low-pass filter (first-order low-pass active filter, second-order active filter model, second-order low-pass filter characteristics, Sallen-Key unity gain filter, Sallen-Key equal component filter, higher-order filters), High-pass active filter, band-pass filter (single op-amp band-pass filter, multistage band-pass filter, state variable filter).

Non-linear Circuits: Logarithmic amplifiers, Log/antilog modules, Precision rectifier, Peak detector, Sample and hold circuits, Schmitt trigger, Monostable Multivibrator. IC analog multiplier applications.

Voltage Regulators: Op-amp regulators, IC regulators, Fixed voltage regulators (78/79, XX), SMPS.

EEE 4261 Biomedical Signals, Instrumentation and Measurements

Contact hours/week: 3

Credits: 3

Introduction: Origin of bio-potentials, Cell physiology, Membrane potential, Action potential, Rhythmic excitation of heart, Transducers and electrodes used in medical diagnostics.

Biomedical Instrumentation: Acquisition and review of biomedical signals. Characteristics and properties of bio-signals: Deterministic and Stochastic signals, Stationarity, Ergodicity, Spontaneous and Induced signals. Galvanic skin resistance detector, Respiratory and suction apparatus, ECG amplifier, Pulse beat monitor, Pace maker. Electronic stethoscope, Electronic clinical thermometer, Blood flow and pressure monitoring recorders, Metabolic rate measurement, Application of ultrasonic and laser in biology and medicine, Clinical X-ray equipment, Bio-telemetry.

Health Analytics and Analysis: Biomarker extraction from physiological data, Application of wearable devices from cardiovascular monitoring, Handling missing data. Removal of artifacts from physiological signal, Adaptive and optimal filtering, Multiscale analysis, Classification of biomedical signals.

Applications: Application of biomedical signals in disease detection and classification. Applications of ECG and EEG in brain computer interface.

EEE 4262 Biomedical Signals, Instrumentation and Measurements Sessional

Contact hours/week: 3/2

Credits: 3/4

Sessional based on the theory of course **EEE 4261**.

EEE 4263 Transducers and Instrumentation

Contact hours/week: 3

Credits: 3

Transducer Elements: Analog and digital transducer, Active and passive transducer. Construction, Operating principle and Characteristics of Resistive, Inductive and Capacitive transducer, Strain Gauge, Light dependent transducer, LVDT, Piezoelectric, Hall effect transducer, Thermistor, Thermocouple, RTD, Proximity transducer.

Motion Measurement: Relative and absolute motion, Linear and rotational motion measurement. Force measurement: Pneumatic and elastic force, Measurement of time varying force. Pressure measurement: High, Moderate and Low (Vacuum) pressure measurement. Torque and power measurement: Transmission dynamometers, Non-contact Dynamometers. Temperature measurement: Measurement of ambient temperature, Temperature monitoring and Control, Measurement of high temperature, Use of RTD, Pyrometers. Flow measurement: Linear resistance element flow meter, Ultrasonic flow meter, Electromagnetic flow meter. Hot wire anemometer, Laser Doppler anemometer.

Acoustic Measurement: Sound pressure and power level, Loudness, sound level meter. Microphones, Piezoelectric crystal type microphone, Electrodynamic type microphone, Carbon microphone. Microelectromechanical Systems: Material for manufacturing MEMS, Patterning, Lithography. Smart Sensor: Component of smart sensor, General architecture of smart sensor, Industrial application of smart sensor. Neural sensors and actuators: Microelectrode arrays, neural interfaces, Implantable medical devices: Biofouling, materials and regulation, Sensors for Image and Video signal. Sensor electronic circuit and signal conditioning, Input-Output Characteristics, extract information and data from sensors.

Computer Aided Instrumentation: Example of a few Open loop and Closed loop control system using different Transducers and Personal

computer. Data Acquisition and display: Amplifiers, Compensators, Filters, A-D and D-A converter, Data transmission elements, Display and recording elements. Wireless sensor interfaces with MCUs: Arduino, STM32 and ARM processors, Sensor networks and wireless power.

EEE 4264 Transducers and Instrumentation Sessional

Contact hours/week: 3

Credits: 3

Sessional based on the theory of course **EEE 4263**

EEE 4265 Integrated Optics

Contact hours/week: 3

Credits: 3

Introduction: Brief history of optical communication, Advantages of integrated optics configuration; Typical integrated-optic components; examples of capabilities

Review of Wave Propagation: Wave vector, Properties of plane waves, Reflection/transmission at a dielectric interface, Phase matching, Total internal reflection, Reflection and transmission coefficients.

Planar Slab Guides: Ray optics, B-V curves for TE/TM modes, Number of modes, Goos-Hänchen shift, Fields-based analysis, Characteristic equation for TE mode, Graphical solution, ω -kz diagram, Asymmetric slab guide, Characteristic equation, Dispersion relation Power flow, Symmetric and asymmetric guides, Effective guide thickness, Radiation modes, Characteristic equation, Graphical solution.

Planar Graded-index Waveguides: WKB method, Normalized characteristic equation, Parabolic index profile, Ray trajectory.

Channel Waveguides: Effective-index method, Marcatilli's method, Gaussian approximation, Design of single mode guide.

Bent and Curved Waveguides: Corner bend waveguides, S-bends, Curved waveguides, Plane-wave, Spectrum of finite width beams, Attenuation constant for curved waveguides, Equivalent index Profile, Modal field offset.

Branching Waveguides: Tapered waveguides, Branching waveguides, Super-modes, Scattering loss in a Y-junction, Various types of power dividers

Waveguide Excitation: End coupling; Prism coupling, M-lines; Grating coupling

Measurements and Evaluation: Measurement of propagation constant, Mode profile, Measurement of waveguide parameters, Step-index and graded-index planar waveguides, Measurement of transmission loss.

EEE 4267**Semiconductor Devices**

Contact hours/week: 3

Credits: 3

Reviews of Compound Semiconductor: Zinc-blend crystal structures, Growth techniques, Alloys, Band gap, Basic opto-electronic properties, Density of carriers in intrinsic and doped compound semiconductors.

Introduction to Physics of Hetero-Junctions: Band alignment, Band offset, Anderson's rule, Single and double sided hetero-junctions, Quantum wells and quantization effects, Lattice mismatch and strain and common hetero-structure material systems.

Hetero-Junction Diode: Band banding, Carrier transport and I-V characteristics. Hetero-junction field effect transistor: Structure and principle, Band structure, Carrier transport and I-V characteristics. Nonideal effects, Frequency response, High electron mobility transistor.

Hetero-Structure Bipolar Transistor (HBT): Structure and operating principle, Quasi-static analysis, Extended Gummel-Poon model, Ebers-Moll model, Secondary effects and Band diagram of a graded alloy base HBT.

Resonant Tunneling Diodes: Physics and operation. Resonant Tunneling Transistors: Device physics, Operation and characteristics.

EEE 4269**Photovoltaic System Design**

Contact hours/week: 3

Credits: 3

PV Systems, Components and Design Basics: PV cells, Modules and arrays, Efficiency, I-V curves and MPPT, Irradiance and temperature responses, Series and parallel connections.

PV Module and Array Configurations: PV cells, Modules and arrays, Efficiency, I-V curves and MPPT, Irradiance and temperature responses, Series and parallel connections.

Batteries and Charge Controllers: Battery design, Capacity and charging characteristics, Series and parallel connections, Charge controllers.

Inverters: DC and AC waveforms, Inverters for different system types, Microinverters, String inverters and optimizers, Voltage, Current and power ratings.

System Sizing Strategies: Sizing strategies for grid-connected PV systems, Sizing strategies for battery-based PV systems.

Array Mounting Considerations: Roof mount systems, Ground mount systems, Pole mount systems, Live and dead loads.

Electrical Design and Code Considerations: Introduction to the National Electrical Code (NEC), Conductor sizing and derating, Combiner boxes, Disconnect switches and Overcurrent protection, Grounding.

Interconnection, Testing and Commissioning: Interconnection codes and standards, Permit requirements, Safety, Start-up procedures.

EEE 4271 Compound Semiconductor Devices

Contact hours/week: 3

Credits: 3

Reviews of Compound Semiconductor: Zinc-blend crystal structures, Growth techniques, Alloys, Band gap, Basic opto-electronic properties, Density of carriers in intrinsic and doped compound semiconductors.

Introduction to Physics of Hetero-Junctions: Band alignment, Band offset, Anderson's rule, Single and double sided hetero-junctions, Quantum wells and quantization effects, Lattice mismatch and Strain and common hetero-structure material systems.

Hetero-Junction Diode: Band banding, Carrier transport and I-V characteristics. Hetero-junction field effect transistor: Structure and principle, Band structure, Carrier transport and I-V characteristics. Nonideal effects, Frequency response, High electron mobility transistor.

Hetero-Structure Bipolar Transistor (HBT): Structure and operating principle, Quasi-static analysis, Extended Gummel-Poon model, Ebers-Moll model, Secondary effects and Band diagram of a graded alloy base HBT.

Resonant Tunneling Diodes: Physics and Operation.

Resonant Tunneling Transistors: Device physics, Operation and Characteristics.

EEE 4273 Nanotechnology and Nanoelectronics

Contact hours/week: 3

Credits: 3

Why Nanotechnology: Importance, Size scales, Quantum size effects, Revolutionary applications, Potentials.

Nanotools: Scanning tunneling microscope, Atomic force microscope, Electron microscope, Measurement techniques based on fluorescence, Other techniques.

Basics of Fabrication: Fabrication and processing industry, Wafer manufacturing, Deposition techniques: Evaporation, Sputtering, Chemical vapor deposition, Epitaxy; Wet and dry etching techniques; Photolithography, Electron beam lithography, Stamp technology. Bottom-up processes: Chemical and Organic synthesis techniques, Self-assembly, Other techniques.

Nanoelectronics: Overview of quantum mechanics, Schrodinger equation, Particle in a box. Band theory of solids. Importance of nanoelectronics, Moore's law, ITRS roadmap.

Tunneling Devices: Quantum tunneling, Resonant tunneling diodes. Single electron transistor: Coulomb blockade. Quantum confinement: Wires and dots, Carbon nanotubes, Graphenes. Brief introductions on Molecular electronics and Nanobiology.

Communication Track

EEE 4181

Digital Communication

Contact hours/week: 3

Credits: 3

Overview of Digital Communication: Basic block diagram of digital communication and the function of each block. Digital transmission and reception of baseband signal, Transmission of message in the form of 8-ary and 32-ary symbols.

Characterization and Modeling of Fading Channels: Slow and Fast Fading, Frequency-Flat and Frequency-Selective Fading, Modeling of Flat-Fading Channel, Log-Normal Shadowing and Composite Multipath/Shadowing.

Mathematical Modeling of Information: Entropy, Relative entropy, Joint entropy, Mutual information, Relation between entropy and mutual information. Channel capacity: Ergodic capacity and Outage capacity, Capacity of MIMO fading channel and MIMO fading interference channel. Ergodic capacity of SISO, SIMO, MISO and MIMO Channels. Outage probability: Definition and physical meaning, Outage probability of SISO and SIMO channels.

Coding: Channel coding theorem, Zero-Error Codes, Fano's Inequality and its converse to the coding theorem, Law of large numbers, Universal source coding: Universal coding for binary sequences, Arithmetic coding, Source coding with side information.

EEE 4182

Digital Communication Sessional

Contact hours/week: 3/2

Credits: 3/4

Sessional based on the theory of course **EEE 4181**.

EEE 4183

Information and Coding Theory

Contact hours/week: 3

Credits: 3

Entropy and Mutual Information: Entropy, Joint entropy and Conditional entropy, Relative entropy and Mutual information, Chain rules for entropy, Relative entropy and Mutual information, Jensen's inequality and log-sum inequality Differential Entropy: Differential entropy and Discrete entropy, Joint and conditional differential entropy, Properties of differential entropy, Relative entropy and Mutual information, Entropy Rates of Stochastic Process: Markov Chain, Entropy rate and hidden Markov models

Source Coding: Kraft inequality, Optimal codes, Huffman code and its optimality, Shannon-Fano-Elias coding, Arithmetic coding channel capacity: Binary symmetric channels and properties of channel capacity, Channel coding theorems, Joint source and channel coding theorem, Block coding

and decoding, BCH, RS codes, Convolutional coding, Viterbi Decoder, Turbo codes, Decoding techniques STBC, SFBC, STFBC Gaussian **Channel:** Introduction to Gaussian channel, Band limited channel, Parallel Gaussian channel, Gaussian channel with feedback.

EEE 4184 Information and Coding Theory Sessional

Contact hours/week: 3/2

Credits: 3/4

Sessional based on the theory of course **EEE 4183**.

EEE 4185 Mobile Cellular Communication

Contact hours/week: 3

Credits: 3

Introduction to Cellular System: Cell, Cell sizes and formats, Shapes of cell, Sectorization of cell, Sector antenna, Mobile antenna, Frequency band reuse. Transmission: Direct and indirect transmission, Simplex and duplex transmission. Generation: an overview of first, second, third, fourth, fifth and sixth generation of mobile communications and their comparison.

Cellular Network: Concept of cellular networks, Architectures of analog and digital cellular networks. Comparison between telephone network and cellular network. Expressions of received signals at the mobile station and base station.

Switching Technologies in Mobile Communication: Circuit switching, Packet switching, Circuit-Switched system, Packet-Switched system. Architecture of general packet radio service (GPRS)-core network.

Cellular Radio System: Frequency reuse schemes, Frequency reuse schemes, Number of customer in the system, Co-channel interference, Interference reduction factor. Handoff Mechanisms, Cell splitting, Dropped call rate. Mobile Radio Channel: Fading and its classification, Modeling and simulation of mobile radio channels. Spectrum efficiency, Delay power spectrum, Doppler power spectrum. Frequency Hopping.

Mobile Radio Propagation: Architecture of Base station, Design of base transceiver station with sector antennas, Propagation loss, Wireless LAN, Paging system. Hybrid multiple Access techniques: FDMA-TDMA, OFDMA-TDMA, MC-CDMA, W-CDMA, CDMA-2000, UMTS.

Global System for Mobile Communication (GSM): Principle of GSM, Services of GSM, Basic network architecture of GSM, Steps of call establishment.

EEE 4187 Underwater Acoustic Signal Processing

Contact hours/week: 3

Credits: 3

Introduction: Adaptive systems - definition and characteristics - open-and closed-loop adaptation - adaptive linear combiner - input signal and weight vectors - desired response and error - performance function.

Theory of Adaptation: Properties of the quadratic performance surface - normal form of the input correlation matrix - eigenvalues and eigenvectors of the input - correlation matrix - geometrical significance of eigenvectors and eigenvalues.

Performance Surface: Methods of searching the performance surface - basic ideas of gradient search methods - simple gradient search algorithm - gradient estimation and its effects on adaptation - gradient component estimation by derivative measurement - derivative measurement and performance penalties with multiple weights.

Adaptive Algorithms: The LMS algorithm - derivation of the LMS algorithm - convergence of the weight vector - an example of convergence - learning curve noise in the weight-vector solution.

Applications: Adaptive modeling and system identification - adaptive modeling of a multipath communication channel. inverse adaptive modeling deconvolution and equalization - general description of inverse modeling-adaptive equalization of telephone channels - the concept of adaptive noise canceling - stationary noise-canceling solutions, filtered-x LMS algorithm - adaptive arrays - sidelobe cancellation - beam forming with a pilot signal-spatial configurations, adaptive algorithms.

EEE 4281

Antennas and Propagation

Contact hours/week: 3

Credits: 3

Antenna Fundamentals: EM wave generation with a conduction current. The radiated electric and magnetic fields, Poynting vector, Plane waves. Hertzian dipole, Isotropic radiator, Introduction to Maxwell's equations. Introduction to directivity, Gain, Radiation efficiency, Radiation resistance, Bandwidth, Radiation patterns, Effective area, Polarization, Axial ratio, Near field, Far field, Friis transmission equation, Link budget.

Wire and Loop Antennas: Monopole antenna, Infinitesimal dipole Antenna, Small dipole antenna, Finite length dipole antenna, Half-wavelength dipole antenna, Folded dipole antenna, Vivaldi antenna, Small circular loop antenna, Ferrite loop antenna, Polygonal loop antenna, Long wire antenna, V antenna, Rhombic antenna, Helical antenna, Yagi-Uda antenna, Frequency independent antenna, Log-Periodic antenna.

Aperture and Reflector Antennas: Huygens' principle, Babinet's principle, Rectangular apertures, Circular apertures, Ground plane edge effects, Plane reflector, Parabolic reflector, Horn antennas.

Microstrip and Mobile Communications Antennas: Introduction to microstrip patch antennas, operation, Feeding techniques, and Impedance matching of microstrip patch antennas, Dielectric resonator antennas. Mobile station antennas, Base station antennas, Planar inverted f antennas.

Reconfigurable Antennas: Introduction to frequency, Patterns and polarization reconfigurable antennas, mechanical and electronic reconfiguration mechanisms.

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.

Antenna Measurements: Antenna ranges, Radiation patterns, Gain, Directivity and polarization measurement techniques, Use of baluns in antenna measurement.

Radio Wave Propagation: Ground wave propagation, Ionospheric propagation, Plane earth loss, Spherical earth effects. Diffraction and Huygens principle, Knife-Edge diffraction, Fresnel zones, Tropospheric refraction.

EEE 4282 Antennas and Propagation Sessional

Contact hours/week: 3/2

Credits: 3/4

Sessional based on the theory of course **EEE 4281**.

EEE 4283 Radar and Satellite Communication

Contact hours/week: 3

Credits: 3

Radar Systems Overview: Basic principles, Antennas for radar, Radar receivers, Radar transmitting system, and duplexer. Radar equation, Reflection of electromagnetic waves, Information content in radar signals, Radar signal wave-forms (pulse, chirp, staggered, hopping, OFDM), Propagation effects, Noise, Radar clutter, Chaff, Resolution and accuracy,

Radar Classification: Continuous wave radar (CW-radar), Doppler mode, frequency modulated continuous wave radar (FM-CW-radar), Pulsed radar, Different modes of operations, Pulse compression techniques, Signal processing, Tracking and parameter estimation, Practical application: the use of a pulsed radar to identify moving targets (MTI-radar).

Synthetic Aperture Radar (SAR): Theoretical concepts, Generation of two- and three-dimensional radar images, Different implementations of SAR-processors.

Radar Cross Section (RCS): Characterization of the scattering and reflection of targets, Scattering behavior of simple targets, Principles of reducing the radar cross section.

Fundamental of Satellite: Structure, System elements, Frequency spectrum allocation, Basic antenna types and relationships with spacecraft, Antennas in practice, Large earth station antennas, Orbital configurations and mechanics, Kepler's laws, Earth orbit satellites, Look angles and orbital perturbations, Launching: Technology, Interferences and risk management, Subsystems, AOC subsystem, TTCM subsystem, Power and antenna subsystems, Transponders, earth segment subsystem, Multiple access techniques, Distortion and impairments: Digital signal impairment, Transponder intermodulation impairment, Uplink and downlink RF

interference, Satellite services: Television broadcasting, Military, Global positioning system, VSAT technology.

Microwave Link design: Link budget analysis and link margin.

EEE 4284 Radar and Satellite Communication Sessional

Contact hours/week: 3/2

Credits: 3/4

Sessional based on the theory of course **EEE 4283**.

EEE 4285 Optical Fiber Communication

Contact hours/week: 3

Credits: 3

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: Electromagnetic 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.

Nonlinear Effects in an Optical Fiber: Stimulated Brillouin Scattering, Stimulated Raman Scattering, Kerr Effect Nonlinearity and Nonlinear Schrodinger Equation.

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.

EEE 4286 **Optical Fiber Communication Sessional**

Contact hours/week: 3/2

Credits: 3/4

Sessional based on the theory of course **EEE 4285**.

EEE 4287 **Multimedia Communication**

Contact hours/week: 3

Credits: 3

Multimedia Fundamentals: Concept, Structure and data Elements of multimedia, Traditional media data streams, Forms of multimedia, Computer based animation steps, Interactive media, Network components, Media types and classification, Modes of media transmission.

Multimedia System Design: Multimedia document architecture and structure, document imaging, International multimedia standards.

Data Compression: Modes of compression, Lossless and lossy compression, Compression coding standards, Compression efficiency.

Multimedia Over IP: Internet protocol, Conferencing, Multicast, RTP/RTCP, RSVP, Packetization, Streaming.

Networking Issues: Error resilience, Quality of service.

Multimedia Storage and Retrieval: Storage and retrieval, DISC, DISK, Disk spanning, RAID.

Multimedia on the Internet: Social media, Personal selling, Webpages, Websites, Hyper text, Hyper media, Information kiosks.

Multimedia Over ATM: Asynchronous transfer media, Synchronous transfer mode.

Emerging Multimedia Technologies: HDTV, UHDTV, Vocaloids, 3D generators, Webcam 2D motion capture, Animation motion capture, Holographic displays.

EEE 4289 **Wireless Communication**

Contact hours/week: 3

Credits: 3

Overview: History of wireless communication, Basic concept, Signal propagation and path loss, Noise and interference.

Channel Models: Multipath fading and its characteristics, Types of fading channels.

Modulation Techniques: Analog and digital modulations, Matched filter and detection theory. **Coding:** Source and channel coding.

Diversity: SISO, SIMO, MISO and MIMO.

Network Design: Capacity and outage, Resource management.

Multiple Access Techniques: TDMA, FDMA, ALOHA packet radio, SS-CDMA.

Applications: Radio, Cellphone, WLAN, Bluetooth, Wireless sensors, IoT.

EEE 4291 Microwave Devices and Circuits

Contact hours/week: 3

Credits: 3

Microwave Circuits: Introduction to High frequency systems and circuits, UHF Transmission lines, Micro-strip circuits, Slot line, Integrated microwave circuit design principles, Passive circuits, Impedance transformers, Filters, Hybrids, Isolators etc.

Microwave Electronics and Devices: Transit time effect and velocity modulation, Microwave amplifier and oscillator, Klystron (multicavity klystron and reflex klystron), Magnetron, Travelling wave tube (TWT), Semiconductor Microwave devices (TEDs, READ diode, IMPATT diodes, TRAPATT diodes, BARITT diodes, Parametric devices).

Microwave Antenna, Waveguide Devices and Applications: Horn antenna, Rhombic and slot antenna, Parabolic antenna, Antenna arrays and their feeding techniques, Waveguide devices including slots, Substrate integrated waveguides and leaky wave antennas, Isolators, and T-junctions, Microwave oven-principles and operation.

Microwave Detection and Measurements: Measurement of impedance, Power, Attenuation, Noise, Mismatch corrections, Accuracy and uncertainty, Vector network analyzer (VNA) basics, Cables and connectors, Calibration methods, Calibration in coaxial line, Calibration on-wafer, Extended VNA practical session-calibration, Measurement and verification.

EEE 4293 Telecommunication Networks

Contact hours/week: 3

Credits: 3

Introduction to telecom system and networks, Essentials of a telecom network.

Telecommunication Switching System: TDM switching, Space division switching, Time-space Switching, Circuit switching and packet switching, Switching fabrics. Integrated services digital network (ISDN), Broadband ISDN (B - ISDN), Switching and signaling techniques in ISDN, Signaling system-7 (SS - 7), ISDN protocols and standards.

Telecom Network Architectures, Network Topology: Ring, Bus, Tree, Star, Architecture of a node, Functions of a node; Routing and switching, Principles of routing, Hot potato routing, Deflection routing, Virtual path routing, Shortest path routing etc. Access technologies: Conflict free multiple.

Access Techniques: FDMA, OFDMA, TDMA, CDMA, Demand assignment multiple access, (DAMA), CSMA-CD, CSMA-CA. Network protocol stack, IP protocol, Voice over IP (VoIP), Asynchronous transfer Mode (ATM) technology, IP over ATM, Synchronous optical network (SONET) and synchronous digital hierarchy (SDH), IP over SONET, SONET over WDM networking access, Network technologies: Hybrid fiber coax (HFC), fiber to the X (FTTX), Ethernet passive optical network

(EPON), Gigabit PON (GPON). Next generation networking (NGN), Next generation SONET/SDH, Networks and standards, Multiple protocol label switching (MPLS), MPLS over WDM.

Interdisciplinary Courses

EEE 4121 Introduction to Machine Learning

Contact hours/week: 3

Credits: 3

Fundamental Concepts of Machine Learning: Introduction to the fundamental concepts in machine learning, basic definitions, types of learning, hypothesis space and inductive bias, evaluation, cross-validation, probability and linear algebra for machine learning.

Supervised Learning: Linear and non-linear classification techniques, parametric and non-parametric algorithms, linear regression, logistic regression, decision trees, support vector machine, kernel tricks of support vector machine.

Unsupervised Learning: Principal component analysis, dimensionality reduction, anomaly detection, k-means clustering, adaptive hierarchical clustering, Gaussian mixture model, expectation maximization,

Deep Learning: Introduction to neural networks, multilayer network, backpropagation, deep neural network, convolutional neural network, autoencoder and reinforcement learning, optimization of deep neural network, applications of deep learning techniques.

EEE 4122 Introduction to Machine Learning Sessional

Contact hours/week: 3/2

Credits: 3/4

Sessional based on the theory of course **EEE 4121**.

EEE 4221 Artificial Intelligence and Advanced Machine Learning

Contact hours/week: 3

Credits: 3

Fundamental Concepts of Artificial Intelligence and Machine Learning: Introduction to the fundamental concepts in artificial intelligence and machine learning, Mathematical background, Modeling and cross-validation methods, Probability and linear algebra for artificial intelligence, and Introduction of supervised and unsupervised machine learning techniques.

Deep Learning: Introduction to neural networks, Multilayer network, backpropagation, Deep neural network, convolutional neural network, Auto encoder and reinforcement learning, Generative adversarial network,

Advanced deep learning architectures, Recent trends in deep learning architectures and applications of deep learning techniques.

Optimization Techniques: Optimization basics, Loss function derivatives, Gradient descent, stochastic gradient descent, Optimization techniques for deep learning model, Effective training of deep learning model, Regularization for deep learning, Improving performance of neural networks, Introduction to interpretability and explainability of deep learning model.

EEE 4222 Artificial Intelligence and Advanced Machine Learning Sessional

Contact hours/week: 3/2

Credits: 3/4

Sessional based on the theory of course **EEE 4221**.

EEE 4223 Robotics and Automation

Contact hours/week: 3

Credits: 3

History of robotics, Elements of robotic systems, Mathematics of manipulators, Classification of robots, Kinematic modelling, Forward and inverse dynamics, Robot path planning, Navigation, and localization, Various types of sensor operations for robot sensing, Electrical and mechanical actuators, Robot vision, Linear and non-linear controls, adaptive controls, Microcontroller and embedded systems for robotics, robot programming, AI and machine learning for robot operations, Robot applications for industry 4.0: Underwater robotics, Unmanned aerial vehicle (UAV), Humanoid robots.

EEE 4224 Robotics and Automation Sessional

Contact hours/week: 3/2

Credits: 3/4

Sessional based on the theory of course **EEE 4223**.

EEE 4225 Advanced Embedded System Design

Contact hours/week: 3

Credits: 3

History of embedded systems, Classification of embedded systems based on generation and complexity, Purpose of embedded systems, The embedded system design process-requirements, Specification, architecture design, Designing hardware and software, Components, System integration, Applications of embedded systems, and characteristics of embedded systems.

Introduction to Microcomputer: Basic components of a microcomputer system, Functional blocks of microprocessor, Microprocessor buses, Evolution of microprocessors, Advanced microprocessors, 16-bit, 32-bit

and 64-bit Architecture, ARM/Cortex microcontroller: STM32 **Microprocessor:** Features, Architecture, Minimum/maximum mode operation of ARM microprocessor, Register layout, Memory organization, and timing diagrams of read and write cycles, Memory banks.

ARM/Cortex microcontroller

Assembly Language Programming: ARM Cortex Microcontroller, Register Model & Addressing Modes, ARM Cortex Assembly Language Programming, and ARM Cortex Instruction Set: CISC, RISC, Data transfer and manipulation instructions, Arithmetic instructions, Logical and bit operations, Branch instructions, Advanced assembly programming, C programming, KEIL μ vision, Software delay, Programming techniques, Assembly process, Loops, Stack and stack pointer, Subroutines and parameter passing, Mixing C and assembly, Parallel I/O, Exceptions: Resets and interrupts, SysTick real time clock, Fixed-Point and floating-point numbers, ARM cortex serial I/O, Analog to digital converter, Adding memory to processor.

Communication Interface: Onboard communication interfaces-I2C, SPI, CAN, Parallel interface, External communication interfaces-RS232 and RS485, USB, infrared, Bluetooth, Wi-Fi, ZigBee, GPRS, GSM, Introduction to embedded systems.

Hardware Interfacing with ARM/Cortex microcontroller, D/A and A/D converter, Sensors, Actuators and their interfacing, Microcontroller development boards and embedded programming platforms, Hands-on and demonstration: Temperature sensing unit, Light sensing unit, Sound sensing unit, Feedback control system, Relay control unit, Driving electrical appliances like motors, Bulb, pump, etc., Object tracking using GPS and GSM, Introduction to internet of things, Smart home concepts, Motion sensing using accelerometer, Control of appliances over SMS.

EEE 4226 Advanced Embedded System Design Sessional

Contact hours/week: 3/2

Credits: 3/4

Sessional based on the theory of course **EEE 4225**.

CSE 4221 Computer Networks

Contact hours/week: 3

Credits: 3

Switching and multiplexing, ISO, TCP-IP and ATM reference models. Different data communication services: Physical layer- wired and wireless transmission media, Cellular radio: Communication satellites, Data link layer: Elementary protocols, Sliding window protocols, Error detection and correction, HDLC, DLL of internet, DLL of ATM, Multiple access protocols, IEEE.802 Protocols for LANs and MANs, Switches, Hubs and bridges, High speed LAN, Network layer: Routing, Congestion control,

Internetworking, Network layer in internet: IP protocol, IP addresses, ARP, NI in ATM transport layer: Transmission control protocol, UDP, AT M adaptation layer; Application layer: Network security, Email, Domain Name system; Simple network management protocol, HTTP and world wide web.

CSE 4222 Computer Networks Sessional

Contact hours/week: 3/2

Credits: 3/4

Sessional based on the theory of course **CSE 4221**.

Chapter 4

ORDINANCE RELATED TO DISCIPLINE

(Approved in 72nd Syndicate Meeting held on 02/01/2015 and
Confirmed in 73th Syndicate Meeting held on 21/03/2015)

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 and 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 upto six months	Board of Discipline
Director (Students Welfare)	Warning, imposing fine upto 1000/-, suspension and expulsion from the Halls	Vice-Chancellor
Provosts (On resident or attached student of his hall)	Warning, imposing fine upto 500/-, suspension and expulsion from the Halls	Director (Students Welfare)

of residence)	for a period of one academic year.	
Head of Department (On students of his Department)	Warning, imposing fine upto 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. The Director (Students Welfare) will be responsible for enforcement of the disciplinary action taken against a student or a group of students. He shall maintain a register and shall record therein all actions taken against a student for indiscipline and misconduct and also shall record in all character certificates issued by the Director (Students Welfare) to offenders, those actions taken against them it so indicated by the Vice Chancellor and the Board of Discipline unless allowed to be expunged/condoned by the Vice-Chancellor prayer from the offenders.
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 reported 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.